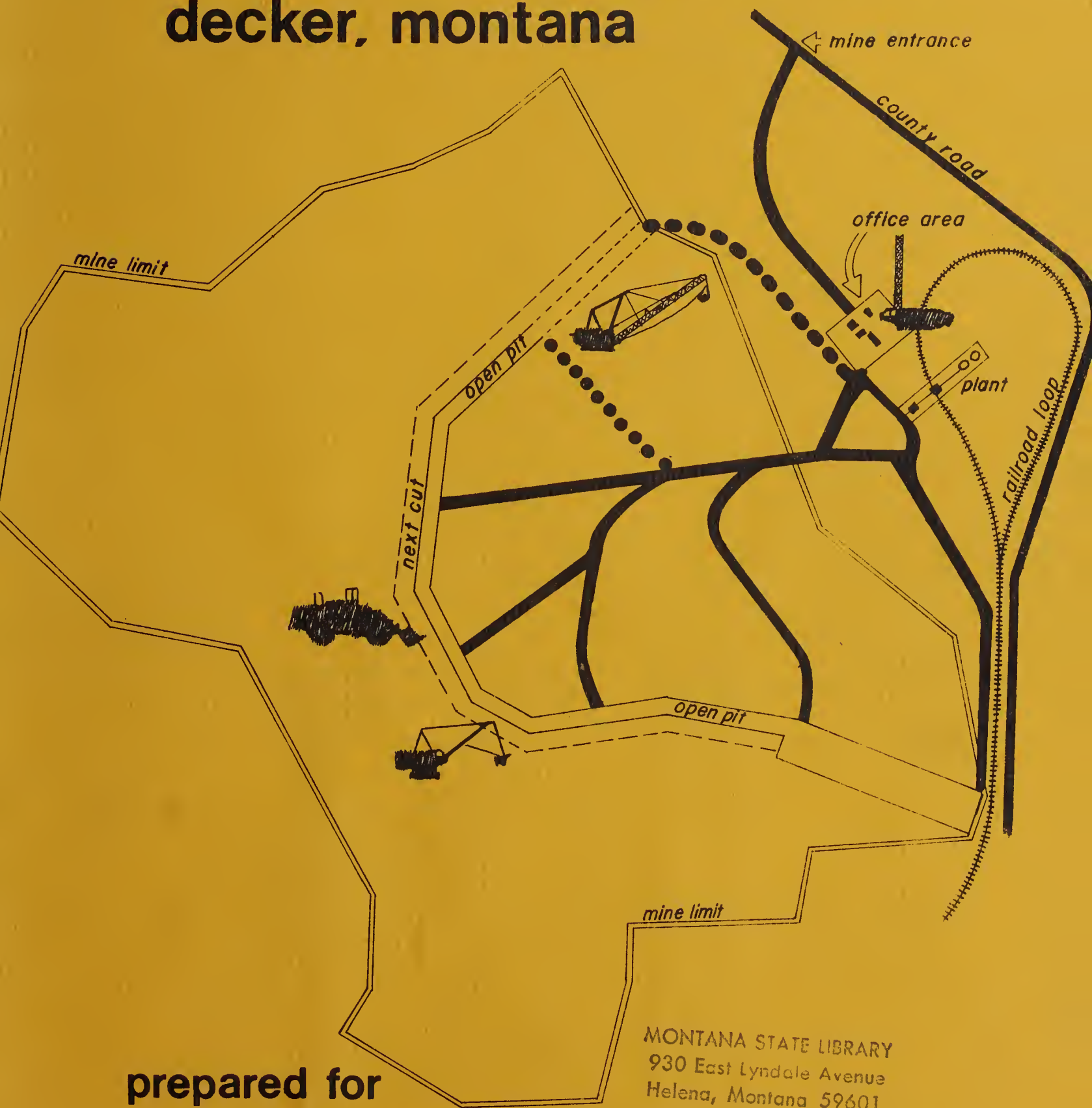


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August 31, 1973

Mr. Jack Ratchye
Decker Coal Company
104 Main Street
Sheridan, Wyoming

Dear Mr. Ratchye:

VTN is pleased to have been able to assist the Decker Coal Company in the preparation of this Environmental Analysis for the Decker Coal Mine in Decker, Montana. This report delineates all environmental impacts that would be attributable to the continued operations at the Decker Mine. We have presented a summary at the beginning of the report that elucidates significant impacts both adverse and beneficial.

This report has been prepared for the State of Montana, Department of State Lands, and is responsive to both the letter and spirit of the State guidelines and regulations, as well as federal law as defined by the National Environmental Policy Act of 1969.

We are appreciative of the cooperation extended us by personnel of the Decker Coal Company. In particular, we would like to thank Mr. Frank Kinney, Mr. Bob Patterson, and yourself for the assistance provided in the data gathering and subsequent analysis necessary for many portions of this report. There are numerous other public and private agencies and groups consulted throughout the study to which we are also grateful.

We sincerely appreciate the opportunity to perform the study, and will be available to present the report findings at any necessary hearings and meetings you may require.

Very truly yours,

A handwritten signature in black ink that reads "Paul J. Epley". The signature is written in a cursive, flowing style.

Paul J. Epley, Ph.D.
Director, Environmental Sciences

PJE:cdh



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ENVIRONMENTAL
ANALYSIS

for

Decker Coal Company Mine
Decker, Montana

Prepared by

VTN Environmental Sciences
2301 Campus Drive
Irvine, California 92664

Prepared for

State of Montana
Department of State Lands
State Capitol
Helena, Montana 59601

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1 SYNOPSIS

1. SYNOPSIS

1.1 Significant Environmental Considerations

Major environmental concerns are primarily localized at the mining site. Three major concerns are (1) alteration of landform, (2) effective reclamation, particularly for future grazing use, and (3) changes in quantity and quality of groundwater, especially as it might affect future agricultural use and native biological systems. These three concerns are interrelated since mining will adversely affect both landform and subsurface geologic structure. The reclamation plan is designed to restore the productivity of the surface for both grazing and wildlife habitat. Changes in subsurface geology may directly or indirectly affect quantity and quality of groundwater. The following table which lists further environmental impacts which may be expected to result from continued operation of the Decker Coal Mine is summarized from Section 7.

Impact		Degree ¹	Duration ²
ADVERSE	Loss of fossil fuel	***	LT
	Landform	***	LT
	Soils	**	ST
	Vegetation	**	ST
	Wildlife	*	ST
	Groundwater Quantity	*	ST
	Growth Inducement	*	LT
	Traffic	*	ST
	Noise	*	ST
	Energy Use	*	ST
BENEFICIAL	Economic	***	ST
	Air Quality in the Midwest	**	ST
	Energy Production	***	ST
	Reclamation Information	**	LT
PROBLEMATIC	Groundwater Quality		LT
	Social		LT
	Aesthetic		LT

¹The number of stars is an approximation of the degree of import.

²LT = long term; ST = short term (lifetime of mine).

1.2 Monitoring Programs and Mitigation Measures

A series of monitoring programs exist for monitoring environmental parameters. These are designed to assess the present impact of the mining operation on the environment and further to provide experience and information to minimize these impacts. Two major programs exist: groundwater monitoring of quantity and quality and research directed toward maximal land surface reclamation. In addition, programs for development of the basic data necessary for reclamation plan designs and methods are in progress. These include continuing studies of the vegetation, soils, wildlife, and physical and chemical properties of overburden. These programs will continue for the lifetime of the mine and should generate the necessary information for maximal mitigation of the major adverse environmental impacts.

1.3 Conclusion

This analysis is designated to delineate and objectively describe the environmental impacts of the existing Decker Coal Mine operation. It is the responsibility of government agencies to recognize, evaluate and weigh the critical factors in regard to the development and utilization of coal fields within their jurisdiction.

2 INTRODUCTION

2. INTRODUCTION

2.1 Purpose

The primary purpose of this report is to delineate and objectively evaluate from an environmental viewpoint the area strip mining operation of the Decker Coal Company in Big Horn County, Montana. Decker Coal Company is presently removing coal from their mine at the rate of 17,000 tons/day. This mining operation is expected to continue for 20 years. This evaluation will serve as a basis for the determination of the environmental effects of the Decker Coal Company Mine and will be used, in part, by the State of Montana, Department of State Lands to determine whether a strip mining permit will be issued.

It is the intent of this report to be a tool by which environmental quality may be assessed and improved and to recommend (1) measures which will minimize any anticipated adverse impacts and (2) alternatives to various aspects of the project which may eliminate or minimize some or all of the unavoidable adverse impacts. However, this report is not to be considered binding for any recommended measure or alternative, but rather to describe the environmental impacts and methods which may minimize them. This report evaluates, in considerable detail, how the operation of the Decker Coal Company mine will affect the immediate environment, nearby vicinity, and regional area relative to physical, ecological, sociological, and economical factors.

2.2 Format

The following Environmental Analysis for the mining operation is submitted pursuant to the Montana Strip Mining and Reclamation Act, Chapter 325, Session Laws of Montana, 1973, Senate Bill No. 94; in accordance with

the "Revised Guidelines for Environmental Impact Statements required by the Montana Policy Act of 1971" adopted by the Environmental Quality Council, July 21, 1972.

The format for this report is a sequential description and analysis of the environmental effects associated with the Decker Coal Company mining operation as expressed in the Table of Contents. In general, the operation and the existing environment are described, the boundaries of the areas are defined, and the nature of these impacts are described. Those measures which would reduce or eliminate some adverse impacts are discussed; however, since some adverse impacts are unavoidable, alternatives to the mining operation are considered. With this background, a more general statement of the operation's effects are given and the resource commitments identified and described. The final sections describe how this project will affect the broad area of public interest and the interrelationships among other planning bodies within the boundaries of the project.

2.3 Authorization

Authroization of this "Environmental Analysis for the Decker Coal Company Mining Operation" is contained in an agreement between the Decker Coal Company and VTN Consolidated, Inc., dated August 17, 1973.

2.4 Information and Data Available

Extensive use was made of existing reports. A complete listing of reference reports, organizations and persons consulted, and other information used in the preparation of this impact statement is included in the reference section. All maps are certified or taken from certified maps previously submitted to the State of Montana, Department of State Lands.

2.5 Acknowledgements

VTN would like to express its appreciation for the helpful assistance of Jack Ratchye, Frank Kinney, Gary Fletcher and Bob Patterson of the Decker Coal Company. In addition, Eunice Synhorst provided excellent secretarial services and Don Snyder contributed draftsmanship necessary in the preparation of this report. Other employees of the Decker Coal Company with whom VTN communicated are listed in Section 16, References.

3 PROJECT DESCRIPTION

3. PROJECT DESCRIPTION

3.1 Location

The Decker Coal Company mining operation is located in Big Horn County, Montana, in the Powder River Basin within the Decker-Birney Resource study area (see Figure 1). The mine area is approximately 20 miles north-east of Sheridan, Wyoming. According to Federal Lease No. 057934-A and Montana State Leases C-1062-71 and C-527-63, the company is entitled to mine coal in the following sections:

SE1/4SE1/4, Sec. 8; S1/2, NE1/4, Sec. 9; Part S1/2, Sec. 10; Part Sec. 15; Section 16; N1/2, SE1/4, Sec. 17; N1/2, N1/2, SW1/4, Sec. 21; and the NW1/4, Sec. 22; all in Township 9 South, Range 40 East (Montana Principal Meridian).

These sections contain approximately 2,725 acres, of which approximately 1500 acres may be mined. The remainder (1,225 acres) presently contains plant facilities, a railroad spur loop, access and haul roads, and work areas used in the mining process (see Composite Map in backpocket).

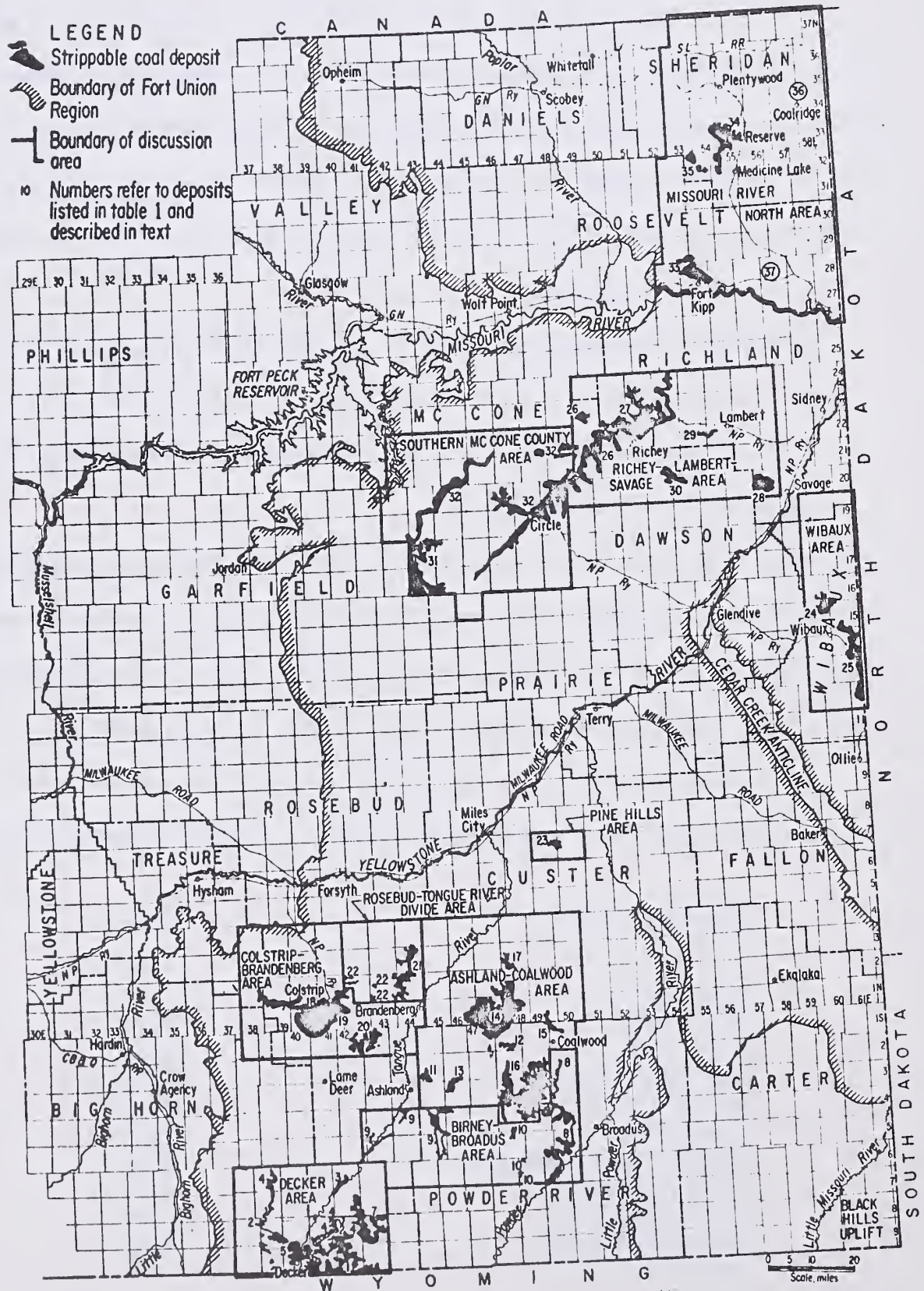
The following table is a listing of the disturbed acreage in the vicinity of the plant facilities and outside the 1500 acres designated for mining.

<u>Designated Area</u>	<u>Acres</u>
Shop Area	9.64
Plant Area	5.40
Truck Dump	7.71
R.R. Loop	22.50
Settling Pond	6.00
Powder House	12.00
Scoria Pit	6.00
Scoria Pit & Dump Area	8.60
Storage Area	8.00
North Haul Road	5.00
South Haul Road	10.30
Top Soil Piles	6.00
TOTAL	107.15 acres

FIGURE 1

REGIONAL LOCATION MAP

(Showing Location of Strippable Coal Deposits in Montana)



Source: U.S. Department of Interior, Bureau of Mines, Strippable Coal Preserves of Montana, 1969.

Of the 1,225 acres outside the designated mining area, 107.15 acres have been disturbed; 1,117.85 acres have not been disturbed.

3.2 Mining Permits

On April 30, 1971, a Reclamation Contract was agreed upon between the Bureau of Mines, State of Montana under Sec. 50-1002, R.C.M., 1947 and the Decker Coal Company (see Appendix, page 224). In general, this original contract included provisions regulating the following: land reclamation, water quality, drainage, shaping of spoil banks, access roads, and bonding. The bond, in the amount of \$20,000, is specifically to insure the restoration of land affected by surface mining of coal. This contract is still in effect.

On February 22, 1971, pursuant to Chapter 224 Session Laws of 1971, the Decker Coal Company filed an Application for Contract and a Plan of Operation and Method and Manner of Reclamation with the State of Montana, Department of State Lands (see Appendix, page 240). This document contains information similar to the original contract but expressed in greater detail. During the review process on this application new laws regarding surface mining applications came into effect.

On July 23, 1973, Decker Coal Company was advised that the Department of State Lands of the State of Montana would require the preparation of an environmental analysis from Decker Coal Company and that the Department of State Lands would prepare an environmental impact statement in order to fulfill its obligations under the Montana Environmental Policy Act. As stated in Chapter 325, M.S.L., 1973, Sec. 28: "Ninety (90) days after the effective date of this act, the State shall proceed to cancel, according to their terms,

all existing contracts entered into pursuant to Chapter 245, laws of Montana, 1967. If the contract does not provide according to its terms, for the cancellation, it shall be terminated and void within two hundred seventy (270) days from the effective date of this act." Accordingly, the Decker Coal Company was notified of the cancellation of the original Reclamation Contract on June 16, 1973. The effective date is December 19, 1973.

3.3 Surface and Mineral Ownership

Both the surface and mineral leases and ownerships of land in the area of the mining operation are illustrated in Figure 2. The mineral leases and ownerships are indicated by the cross-hatching; surface leases and ownerships are expressed by the names printed within their respective boundaries. Two owners of record are not shown: the Montana Department of Natural Resources and Conservation which owns the Tongue River Reservoir and the Highway right of ways owned by the Montana State Highway Department.

The Decker Coal Company, by virtue of the State and Federal leases, is entitled to explore and mine the coal in the area of the operation. The surface rights for private lands in this area were purchased by Decker Coal Company; surface rights on State-owned land are not in conflict with the mining leases. This lack of conflict is due to the simple fact that the State-owned land surface rights are leased to a mining company which always intended to use the land for mining operations.

The owners of record of all surface area adjacent or within one-half (.5) mile of any part of the affected area are the following:

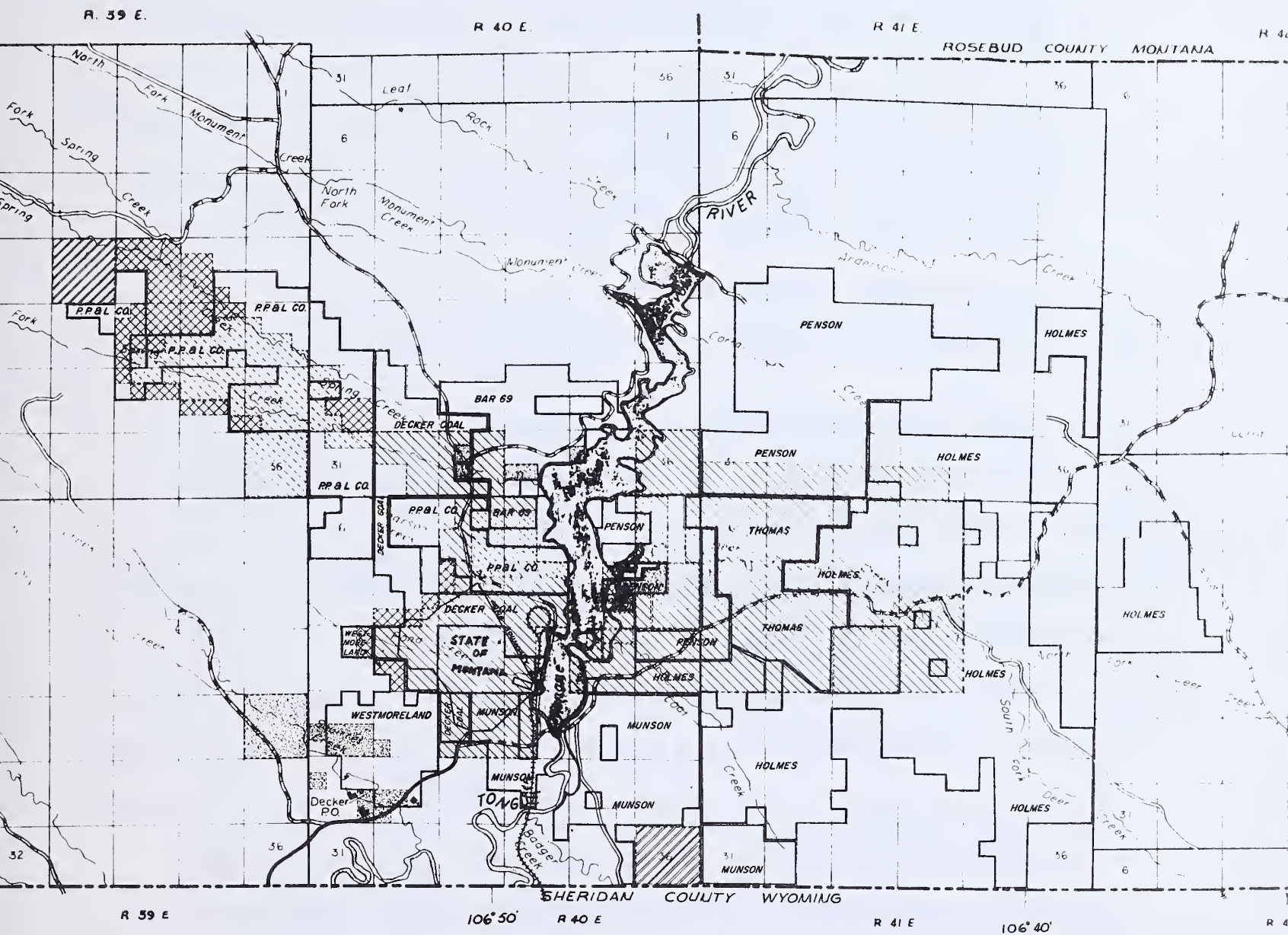


FIGURE 2

SURFACE AND MINERAL OWNERSHIP

BIG HORN COUNTY, MONTANA

LEGEND: MINERAL OWNERSHIP

- DECKER COAL LEASES
- ▨ COAL LEASE APPLICATIONS
- ▤ RP & L COAL LEASES
- ▦ ROSEBUD COAL SALES CO.
- ▧ PETER KIEWIT SONS' CO. COAL LEASES

1. Emmett and Vada L. Munson, Decker, Montana
2. Pacific Power & Light Company, Public Service Bldg., Portland, Oregon
3. Westmoreland Resources, P.O. Box 1883, Billings, Montana
4. Montana Department of Natural Resources and Conservation, Helena, Montana
5. Montana State Highway Department, Helena, Montana
6. Willis W. Elder, Decker, Montana
7. Lawrence Thomas and Marilyn Thomas, c/o Mansel Johnston and Thelma Johnston, Decker, Montana
8. Big Horn County, Hardin, Montana
9. Department of State Lands, State of Montana, Helena, Montana

3.4 Initial Mining, Coal Quality and Construction

Exploratory drilling began in 1963, after obtaining the State and Federal leases. This drilling, which covered the mining operation area, provided information on soil characteristics, geology, depth of overburden, and depth and quality of the coal seam.

In September 1970, Commonwealth Edison Company of Chicago, Illinois, reviewed the exploratory drilling data and requested an extensive coal sample to analyze and actually burn in their generating plants. A 64,000-ton sample was removed, creating the test pit, and shipped to Illinois. The test burning was satisfactory. The following table lists the difference between burning 100% Illinois coal versus 100% Decker coal in air emissions, monitored in the flue gas, at the Will County Station, Unit No. 2, Lockport, Illinois.

	<u>Total Sulfur (as SO₂)</u> <u>% by Volume</u>	<u>SO₃</u> <u>ppm</u>	<u>NO_x</u> <u>ppm</u>
100% Illinois Coal	0.23	19	351-486
100% Decker Coal	0.03	5	313-330

Because of this difference in emissions of sulfur oxides, as well as particulates, Commonwealth Edison Company is able to meet the air quality standards of the City of Chicago, Air Pollution Control Ordinances, Sec. 17-2; Cook County Air Pollution Control Ordinances, Sec. 6.3; and the State of Illinois, Pollution Control Board, Air Pollution Regulations, Rule 203 and Rule 204. The coal sample was also assayed. The results of this assay (conducted by C.T. & E. Co., 228 North LaSalle Street, Chicago, Illinois) are given below:

<u>PROXIMATE ANALYSIS</u>		
	<u>As Rec'd</u>	<u>Dry Basis</u>
% Moisture	23.51	XXXXXXX
% Ash	3.73	4.88
% Volatile	33.50	43.80
% Fixed	39.26	51.32
Carbon		
	<u>100.00</u>	<u>100.00</u>
BTU	9553	12489
% Sulfur	0.33	0.43

<u>ULTIMATE ANALYSIS</u>		
% Moisture	23.51	XXXXXX
% Carbon	55.48	72.53
% Hydrogen	3.73	4.87
% Nitrogen	0.56	0.73
% Chlorine	0.03	0.04
% Sulfur	0.33	0.43
% Ash	3.73	4.88
% Oxygen	12.63	16.52
(diff.)		
	<u>100.00</u>	<u>100.00</u>

% Equilibrium Moisture = 22.23

<u>MINERAL ANALYSIS OF ASH</u>	<u>%</u>
Phos. Pentoxide, P ₂ O ₅	1.17
Silica, SiO ₂	23.28
Feric Oxide, Fe ₂ O ₃	7.44
Alumina, Al ₂ O ₃	20.31
Titania, TiO ₂	1.22
Lime, CaO	17.56
Magnesia, MgO	3.54
Sulfur Trioxide, SO ₃	17.59
Potassium Oxide, K ₂ O	0.58
Sodium Oxide, Na ₂ O	6.40
Undetermined	0.91
	<u>100.00</u>

Alkalies as Na₂O, DCB = 0.33
Silica Value = 44.92

<u>FUSION TEMPERATURE OF ASH</u>		
	<u>Reducing</u>	<u>Oxidizing</u>
Initial Deformation	2160° F	2600° F
Softening (H = W)	2180° F	2540° F
Softening (H = 1/2W)	2190° F	2550° F
Fluid	2225° F	2600° F

Based upon this reduction in air emissions, to a level acceptable to Illinois law, Decker Coal Company contracted with Commonwealth Edison to supply coal for generating electricity, and began construction of the mining plant facility (see Composite Map).

The construction of the plant facilities included erecting a power-line from the Pacific Power & Light Company substation to the site; site grading and leveling for the plant facility buildings and assembly of the dragline, shovel and drill. Also, overburden from the scraper pit was used for the roadbed for both the railroad spur and the relocation of the highway. The relocation of Secondary Road 314 was agreed to by the Big Horn County Commissioners and the location, design and construction were approved by the Montana State Highway Department.

A series of diversion channels and small dams were constructed to intercept and divert runoff water from the Pond Creek drainage basin to the Pearson Creek drainage (see Composite Map); consequently, flooding of the mine area is prevented.

3.5 Project Operation

3.5.1 Area Strip Mining

Mining coal by the area strip method used at the Decker Coal mine consists of a sequence of earth-moving operations. First, the topsoil (0 to 12 inches) is removed by self-loading scrapers and bulldozers and deposited in holding areas (see Composite Map). Secondly, the remaining overburden (30 to 170 feet) is removed after blasting by a dragline (41-cubic-yard bucket) to the depth of the top of coal seam. This remaining overburden material is deposited

in different locations, depending upon whether it is removed from the first cut (box cut) or successive cuts. Overburden material from the box cut is stored in "spoil" piles (see Composite Map); material from successive cuts is deposited in the space left from the preceding cut as shown in Figure 3. The initial phase of the reclamation plan will use the original above-ground spoil pile to backfill between the subsurface spoil piles as shown in Figure 3.

Finally, the coal seam (52 feet) is also blasted and removed by two separate processes: the upper half (25 feet) is loaded into 70-ton coal-hauling trucks by a front-end loader (23-cubic-yard bucket); the lower half (25 to 27 feet) is loaded into the coal-hauling trucks by an electric shovel (16-cubic-yard bucket). The coal-hauling trucks transport the coal from the working face to a 700-ton truck dump and primary crusher.

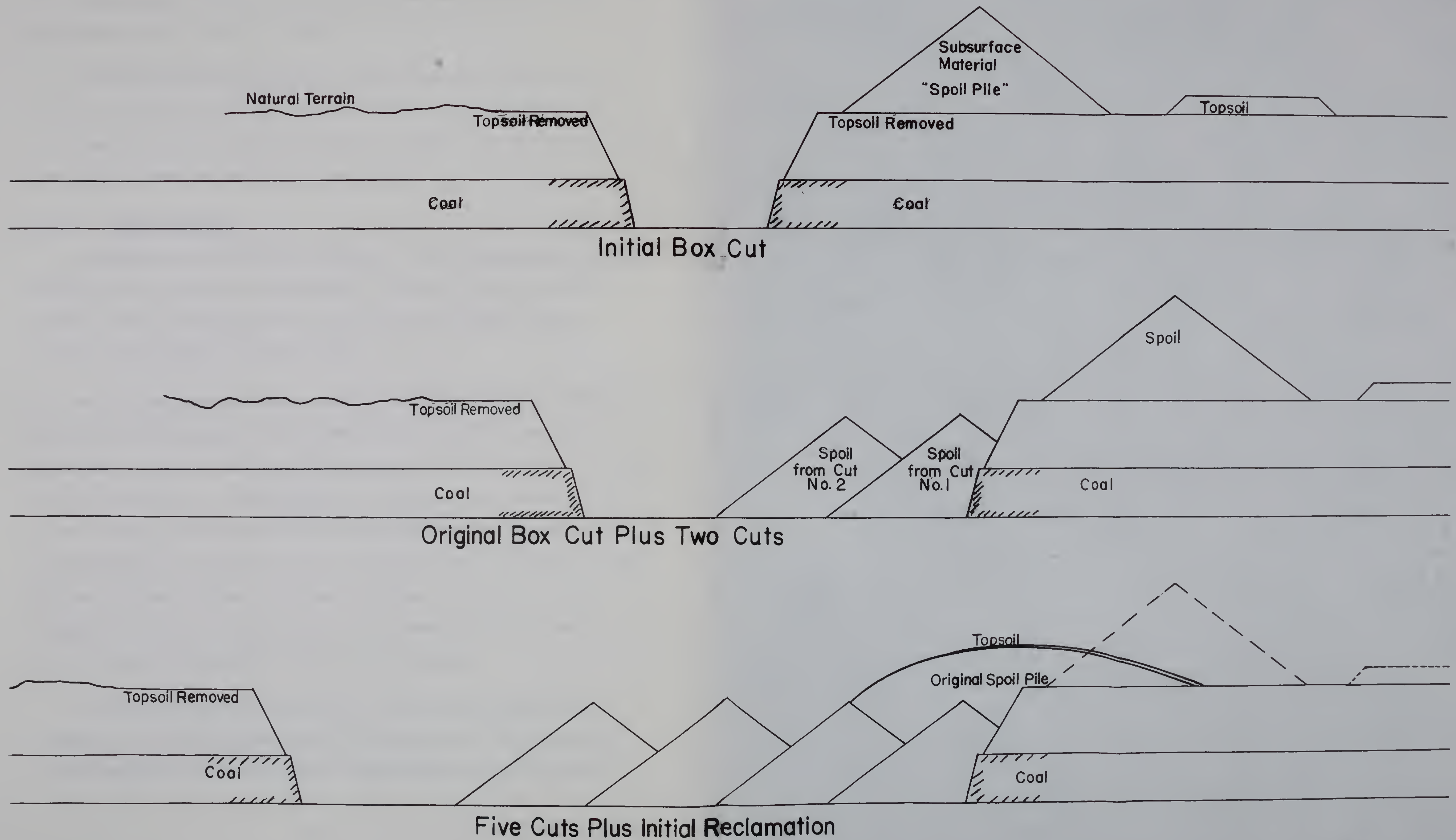
As described in Figure 9, there are two coal seams underlying the mining area: the D₁ (Dietz 1 plus Anderson Seams) and the D₂ (Dietz 2). Because of the depth of the D₂ seam, only the D₁ seam is mined.

3.5.2 Processing

The processing of the coal is limited to an electric primary crusher which reduces the coal to a maximum size of 8 inches; and a second electric crusher which reduces the maximum size to 2 inches. High-speed conveyors transport the coal from the primary crusher through the secondary crusher and to the top of the two storage silos (13,000-ton capacity each) at the rate of 2,000 tons/hour. Coal is transported from the storage silos to the coal tipple (loading facility) at the rate of

FIGURE 3

Schematic Cross Sections of Initial and Successive Box Cuts and Reclamation Procedures



5,000 tons/hour. The coal is loaded into unit trains of 100 railroad cars by "flood loading." The railroad cars pass under the load-out building continuously while the coal is loaded.

Other minor processing operations include continuous weighing while loading and batch sampling for chemical analysis. Coal is tested both as it is received and after drying for moisture content, ash content, BTU/pound and sulfur content (see earlier coal analysis).

3.5.3 Water Management

In addition to the following discussion of water management, the water resources of the mine area are described in Section 5.2 (5.2.1 Drainage Patterns and 5.2.2 Groundwater) and the impacts of the mine on water resources are discussed in Section 7.2.2.

One principal source of water used in the mining operation comes from the D₁ aquifer which percolates through the coal down to the impervious shale rock. There are two major collection basins for this water: the test pit and the low point of the scraper pit. The water level in the test pit is maintained by pumping onto the nearby grassland surface in keeping with existing rules and regulations; it is also used in small quantities to water the test reclamation water plot. The groundwater in the test pit may be expected to eventually disappear as it loses communication with the D₁ aquifer because of interruption by the mining operation.

Water which collects at the low point (sump) in the scraper pit is pumped into the settling pond south of the scraper pit. This pond water is used extensively for dust control. Approximately 150,000 to 200,000

gallons per day are used to water the coal and the haul roads. Overflow from the settling pond (approximately 150 gallons per minute) flows by gravity through a 54-inch-diameter corrugated metal pipe (CMP) under the highway and railroad track. Virtually all the water which enters the settling pond is pumped up from the sump. Consequently, excessive rain and flooding will not overflow the settling pond. Water which flows through the CMP is released into the Tongue River drainage area and flows approximately 500 feet to the discharge point into the Tongue River.

The second major source of water is a well located near the plant facilities (see Composite Map). This well passes through both the D₁ and D₂ aquifers and may draw water from both aquifers plus deeper sources associated with the Tongue River drainage. This well pumps water at the rate of 15 to 25 gallons per minute to the 210,000-gallon storage tank (see Composite Map). The water in the storage tank is used for various purposes: domestic uses such as toilets and showers; industrial uses including dust control in the plant area and washing the coal during loading at the tipple; and safety uses, in particular, supplying the fire hydrants at the site.

3.5.4 Water Quality

Two state programs for monitoring water quality and groundwater levels are in progress. The Montana Bureau of Mines and Geology continuously monitors groundwater levels of both the D₁ and D₂ aquifers from the 14 test wells located throughout the mine site. In 1972, some D₁ aquifer water samples were analyzed to determine water quality at three locations in Township 9 South, Range 40 East: (1) upper elevation of the Pond Creek Drainage Basin above the mine (17ACAD), (2) mine effluent entering Tongue River

(22BADB) and (3) the domestic well at the Montana Club (21CACD) in the town of Decker, Montana (see Composite Map). A summary of a portion of these results at the above locations is given below:

(Units are in mEQ/L)

	(1) Undisturbed groundwater	(2) Mine Effluent	(3) Montana Club
Calcium	0.188	1.10	1.568
Sodium	<u>21.750</u>	<u>24.795</u>	<u>58.942</u>
Total Cations	22.39	28.642	61.823
Bicarbonate	15.62	14.70	32.711
Sulfate	<u>5.684</u>	<u>12.950</u>	<u>27.482</u>
Total Anions	22.311	28.402	61.834
Laboratory pH	8.69	8.51	8.40

The Environmental Sciences Division of the State of Montana Department of Health and Department of State Lands requires monthly water analysis reports at the point of discharge of mine water effluent to the Tongue River. A summary of a portion of these results is given below:

(Units are in ppm)

	1972 Average	June 1973 Outlet CMP	June 1973 Discharge Point	June 1973 Upstream
Alkalinity (CaCO_3)	741	525	192	170
Hardness (CaCO_3)	193	270	380	350
Total Dissolved Solids	1613	1094	370	376
Iron	0.21	0.1	0.2	0.2
Fluoride	1.56	0.9	0.2	0.1
Sulfate	531	438	300	282
pH	8.2	8.5	8.6	8.9

Also included in this table are the results from water quality analysis made in June 1973 at the outlet corrugated metal pipe (CMP), the discharge point and 1500 feet upstream from the discharge point. In addition to these

data, other water samples have been assayed to determine quality at various other locations on the mining site and within the local area. The State of Montana Department of Health, Department of State Lands and Department of Fish and Game (Miles City) receive reports of all water analyses and inspect the water management system at the Decker mine.

There is a separate lagoon for the collection of all water waste from the plant facilities, including the vehicle maintenance area (see Composite Map). Another holding basin is designed to contain runoff wash-water released during the coal-loading process and maintenance washing of other plant facilities. Both of these waste water collecting basins receive limited amounts of water. The water evaporates and the small amount of residue does not require further handling.

3.5.5 Transportation Networks

There are approximately 100 employees at the mining operation of which 17 are supervisory personnel; the remainder are hourly wage employees. Since there are some car pools, approximately 40 to 50 cars travel between Sheridan, Wyoming, and the mine twice daily. Within the site, numerous vehicles operate 8 to 9 hours per day. These include eight coal haulers, one water truck, three patrol graders, and two self-loading scrapers. Some major equipment is relatively stationary. This includes the dragline, the shovel, two front-end loaders, coal saw, overburden drill and two D-9 bulldozers. In addition to these vehicles, railroad trains (100 cars/train) traverse the spur line six to seven times per week.

These may conveniently be subdivided into four distinct categories: (1) the highway systems used for automobiles to transport personnel from Sheridan to the mine; (2) the railroad spur line used to transport coal

from the mine to the main Burlington Northern track junction 8 miles east of Sheridan, Wyoming; (3) the haulage roads on the site used to transport coal from the coal seam face to the coal dump and (4) the remaining vehicles which are relatively stationary. The highway system and the railroad are off-site.

Principal highways used between Sheridan and the Decker Coal Mine include Montana County Road 314 and Wyoming Secondary Road 338. The access point to the mine is a paved road shown on the composite map. The parking areas around the plant facility are also paved. The shop area is also used for equipment storage.

3.5.6 Safety

The Decker Coal mining operation is governed by various Federal, State and company regulations designed to safeguard against accidents or other safety hazards on the site. These standards include the following:

1. Coal Mine Health and Safety Act administered by the U.S. Bureau of Mines: Title 30, Code of Federal Regulations.
2. Commerce and Explosives Act administered by the U.S. Treasury Department: Part 181 of Title 186, Code of Regulations.
3. Mining Laws of The State of Montana administered by the State Workmen's Compensation Commission.
4. Peter Kiewit Sons' Co.: Decker Coal Company Safety Regulations.

As described in the following paragraphs, several safety hazards exist which are inherent to any surface mining operation. In each case, appropriate measures have been taken to reduce or eliminate the potential hazard, as required by the above standards and additional guidelines and company policies.

Traffic control provides a major example of comprehensive safety planning. All traffic enters the site by means of a single access road leading from U.S. Highway 314, a secondary route leading north from Sheridan. Since this route originally passed through the mining site, the Decker Coal Company relocated the road to the east around the site and paved the new section, in addition to the old road, as far south as the Montana Club, thereby increasing the safety of this route. Safeguards have also been adopted in controlling traffic on haul roads within the mining area. Haulage roads are constructed at a 4% grade for safety during winter weather conditions. All trucks are equipped with backup alarms which automatically sound whenever the vehicles move backward. Traffic flow patterns are established each day to serve the area mined, and all drivers are thoroughly briefed before beginning work. In recognition of the potentially hazardous nature of the operation, only experienced drivers are employed. All employees receive additional training after being hired by the company, in which the importance of adhering to safety procedures is stressed.

The Decker Coal Company follows regulations governing blasting and storage established by the U.S. Bureau of Mines, Department of The Treasury, and, as mentioned previously, the Company also complies with the guidelines for blasting developed by the DuPont Chemical Corporation.

Similar precautions are followed to insure personnel safety in other mining and processing areas. Dust resulting from mining operations and truck traffic is reduced by watering of coal loading and haul roads with an 8,000-gallon-capacity truck, which is in continuous operation during working

hours. In compliance with Federal regulations, dust exposure for all personnel is monitored and sent to the Bureau of Mines for analysis, with a maximum of 2 mg/m³ of air dust allowed.

Methane gas, which is released during loading procedures, is controlled by ventilation fans under the storage silos and a methane monitoring system. Employees are required to wear protective devices such as safety glasses and ear plugs to safeguard against noise. Noise levels are also reduced by installation of heavy-duty mufflers on all trucks and by housing the crushers and conveyors.

Numerous mechanical devices are utilized to prevent injury, including emergency stop cables on the high-speed conveyors and 30-second startup alarms for processing and tipple loading operation.

Public safety is protected by fencing along the entire perimeter of the site and by 24-hour security patrols.

3.5.7 Waste Management

The liquid wastes from the plant facilities, including sewage and the surface runoff from the shop area which contains traces of oil, all drain into the sump area located northeast of the plant facilities (see Composite Map).

Solid waste is collected and buried on-site in the scoria pit which was excavated for roadbed material. The plans for the water and sewage systems at the Decker Coal Mine have been approved by the State of Montana, State Department of Health. (See Appendix, Section 17.6.)

3.6 Land Rehabilitation

Reclamation of land disturbed by surface mining is an integral part of the mining operation. The original contract specified numerous requirements for reclamation as part of the original surface mining permit. The final statement of the Proposed Rules and Regulations in Implementing the Montana Strip Mining and Reclamation Act, July 6, 1973, also provides additional specific requirements governing reclamation, as required by Chapter 325, Montana Session Laws, 1973.

3.6.1 Local History

Two examples of reclamation efforts in semi-arid regions of Wyoming which have resulted from land affected by strip mining operations are (1) the Dave Johnston Coal Mine at Glenrock, Wyoming, and (2) the Big Horn Mine at Acme, Wyoming. These represent a range of climatic conditions, soils and vegetation associations, as well as difference in the length of time reclamation efforts have been in operation. These programs provide fundamental experience and information about the feasibility and methodology required for reclamation in this region.

The Dave Johnston Coal Mine land reclamation program began in 1965. A number of important conditions were varied, including different plant species and amounts of seed mixtures, application of different combinations of topsoil, mulch straw and fertilizer. No irrigation was used. The following paragraph, which describes their preferred method, has been excerpted from this report (Dave Johnston Coal Mine Reclamation Program, Pacific Power & Light Company, February 1973):

"The reclamation methods now practiced have provided excellent results. That portion of the spoil bank that will not generally be disturbed in subsequent mining operation is bladed to a gently rolling contour with slopes

seldom exceeding 3H:IV. Topsoil is spread 4 to 6 inches deep with motor scrapers and bladed level with motor graders. A grass hay or small grain straw mulch is blown on the topsoil at the rate of 1 to 3 tons per acre, depending on the steepness of slope. The straw is lightly disced with conventional farm equipment to anchor the straw and provide protection against wind and water erosion. The selected seed mixture is then planted with a standard drill. All work on the spoil area from leveling by the motor scraper to final seeding is accomplished with the equipment traveling parallel to the land contour wherever possible. This minimizes the problems of water erosion during cloudburst-type situations."

Based upon observations reported by personnel from the Pacific Power and Light Company, scientists at the University of Wyoming, Bureau of Land Management, and Soil Conservation Service, the vegetative cover, palatability and animal carrying capacity of the reclaimed land has increased above native vegetation.

The following account is taken primarily from Jones, 1970: The initial reclamation program at the Big Horn Mine in 1967 was on a 3:1 slope of overburden with no topsoil. A pasture mixture of clover and sudan grass was seeded; cottonwood, chokecherry, native plum and ponderosa pine tree seedlings were also planted. Although grass germination was good, there was a high percentage of seedling failure, apparently because of lack of moisture. The following year a second plot, also on a 3:1 slope of overburden without top soil, was seeded and planted. Additional species included oats, caragana and Russian olive seedlings. In this case, the area was fertilized with 30 pounds of nitrogen and 30 pounds of phosphate per acre and irrigated for two growing seasons. Seed germination and survival and seedling survival was high (approximately 75 percent). After 3 years without irrigation or further treatment of any kind, the grasses and trees are established and the density of the grass is increasing. Reclamation efforts have continued at the Big Horn Mine; these have included use of topsoil on graded and established spoil piles, use of other grass species, etc. (Personal communication, Frank Kinney.) It is premature to evaluate these latter efforts.

3.6.2 Reclamation Research

The literature of surface mining reclamation programs and the results of those programs is extensive. Two recent reports (i.e., Research and Applied Technology Symposium on Mined-Land Reclamation, March 1973; The Revegetation of Areas Disturbed by Surface Mining Activities, November 1972) outline some of the numerous considerations of planning, design and experimentation required to develop optimal methods, applicable to each unique situation, which will improve the quality of the overall land reclamation effort. These considerations closely parallel the concept of the environmental impact statement (EIS), as presently described by the State of Montana Environmental Quality Council. Simply stated, the EIS requires a detailed analysis of the existing environment, the proposed project and the impacts, mitigation measures and alternatives to the project. In particular, planning and preliminary analysis of overburden, topsoil, climate, etc., should lead to experimentation and knowledge regarding the following: optional combinations of soil treatments (fertilization, top-soiling, watering and mulching); optimal combinations of introduced and native grasses, forbs, shrubs and trees; and optimal methods of spoil preparations, including grading, weathering, contouring, etc.

At present there are two reclamation research projects in progress at the Decker Coal Company Mine. One is conducted by the Montana Agricultural Experimental Station, Animal and Range Sciences Department, Montana State University. A second is run by the Forest Service, U.S. Department of Agriculture. The former also includes extensive results from study areas at the Western Energy Company Rosebud Mine at Colstrip, Montana. The Montana State University studies document the effects on revegetation rates and densities, of variables such as surface manipulations, soils media, top-soiling depth and gradient, fertilizer, plant species, etc. As part of the

evaluation process, they also contain data on overburden and topsoil analysis and water quality (see Appendix, Section 17.5). A detailed summary of the numerous studies and results is beyond the scope of this report.

However, two studies are especially interesting and relevant. They concern (1) evaluating the development of plant species and communities in terms of successional characteristics and (2) comparisons between long-term and short-term revegetation capability of introduced and native species. Both studies have only begun; consequently, any interpretations are only tentative and long-range conclusions are inappropriate.

The Plant Community Development Study (Montana State University) began in the spring of 1972 at the Rosebud Mine at Colstrip, Montana, operated by Western Energy Company. Approximately 10 acres of raw spoil was shaped and covered with 6 to 8 inches of topsoil. After site preparation, a broad mixture of annual and perennial grasses, shrubs and legumes was seeded. Plant establishment was rapid and the site was stabilized and erosion prevented. The major plant productivity in the first year was due to the annuals; however, after the annuals die surviving perennials are expected to become established. It is also possible that careful analysis of the plant community development on this site will permit comparisons with future possible studies of natural succession on old disturbed areas. These comparisons may permit design of mining reclamation plans which will increase the rate of succession toward a climax community.

The second study, conducted by personnel of the Forest Service working under the SEAM Program, U.S. Department of Agriculture, Intermountain Forest

and Range Experiment Station, Logan, Utah, began in the fall of 1972 on natural subsoil 3 feet below the surface at the Decker Mine. Three plots, each containing 48 subsections, were carefully laid out. The plots were seeded with either native species only, introduced species only or a combination of native and introduced species. The effect of topsoiling will be evaluated by comparing a topsoil block with a control block. The 48 subsections are used to vary combinations of grass species, mulching and fertilization. The selection of grass seeds was based upon an extensive study of the literature, analysis of soil characteristics, determination of climatic conditions, temperatures and incident radiation, and observations and experience of the personnel. The plants were selected on the basis of adaptability to the existing conditions (B. Richardson, personal communication). Continued observation and analysis of these plots may lead to an optimal choice of plant species and soil treatments to maximize land reclamation.

3.6.3 Reclamation Work at the Decker Coal Mine

In addition to the reclamation research projects currently underway at the Decker Mine, some land reclamation work has begun. Prior to the removal of overburden, topsoil has been removed and stockpiled from the mining areas (see Composite Map). Reclamation work was started in 1972 on a total of 261.4 acres. This includes seeding the borrow pits, haul roads and gravel pits used in the construction of the railroad (86 acres); 15 acres of disturbed area from construction work and utility lines; seeding and fertilizing 27.8 acres along the access road and the plant site, and 132.6 acres along 5.1 miles of Montana State Secondary 314.

The selection of seed for revegetation along the railroad was determined after consulting with local ranchers. They selected a mixture of 40 percent slender wheatgrass, 20 percent western wheatgrass and 40 percent crested wheatgrass, at 12 pounds per acre. The ranchers have expressed satisfaction with this revegetation. (Personal communication, H. Burgess, et al, 1973.)

3.6.4 Mining Permit Application, Including Reclamation Plans

The following Preliminary Mining Permit Application, excluding exhibits and figures, is included in this section since it contains extensive information which describes reclamation plans, as defined both in Chapter 325, M.S.L., 1973, Senate Bill No. 94 and the Adopted Rules and Regulations pursuant to Chapter 325, M.S.L., 1973. The format of the application follows the guidelines outlined in these documents. Much of this information has already been included as part of this environmental analysis. This permit application is in the final processes of preparation and is planned for submittal to the State of Montana, Department of State Lands. References to most of the exhibits and figures in this section can be found in other sections of this analysis. For example, the archaeological survey is in the Appendix. The Composite Map, in the backpocket, contains information regarding topography, disturbed areas, et cetera.

INTRODUCTORY DATA FOR SURFACE MINING APPLICATION

Decker Coal Company's mining operation commenced on August 22, 1972, under the Surface Coal Mine Land Reclamation Contract dated February 4, 1971, entered into between the State of Montana, through its Bureau of Mines and Geology and Decker Coal Company.

An application for Surface Mining Permit and informational data pursuant to Chapter 325, Session Laws of Montana, 1973 was submitted June 6, 1973 to the State of Montana, Department of State Lands, for their review and further handling.

The following is informational data to accompany Decker Coal Company's application for Surface Mining Permit under the adopted Rules and Regulations pursuant to Chapter 325, Session Laws of Montana, 1973.

26-2.10(10)-S10270 Application For a Strip Mining Permit

(1) All tests, analyses or surveys carried out pursuant to these rules and regulations will be performed or certified by a qualified person. The method and/or procedures used in a given test, analysis or survey will be described.

(2) Previous materials submitted toward permit application prior to the formal adoption of these rules are being revised to conform with the format of these rules and regulations.

(3) The application for strip mining was made on forms provided by the Department.

(4) Two (2) copies of all maps, reports or other information data will be submitted to accompany the application. In addition to information specifically required in the law, the following information will also be included as part of the application for a strip mining permit:

(a) In May, 1971, arrangements were made by Decker Coal Company with the State-Wide Archaeological Survey Department of Anthropology, University of Montana at Missoula, to conduct an inventory and salvage where appropriate on archaeological resources covering their present mining area. The archaeological survey was completed in July 1971 and a signed antiquities release dated September 19, 1973, has been received stating that all requirements of the Federal Antiquities Act have been met by the Decker Coal Company on the proposed future surface mining areas. A copy of this document of release and the 1971 Archaeological Survey of Decker Coal Company's coal lands in Big Horn County, Montana are enclosed and entered as Exhibit "1".

A Historic Resources Impact Assessment for the Decker Coal Mine area, west of Tongue River, which includes the present mining area, was prepared in August 1973 by the Western Interpretive Services, P.O. Box 6467, Sheridan, Wyoming, giving the historical, ethnological, cultural values of the area to be affected. A copy of this document is enclosed and entered as Exhibit "2".

(b) A description of environment including a brief resume of the topography, scenic and geologic formation and climate of the Decker area is included in the above Archaeological Survey.

(c) In reviewing the above Archaeological Survey, Historic Resources Impact and accompanying pictures, no indications are shown that the permit area possessed special, exceptional, critical, or unique characteristics as defined in Section 9(2), Chapter 325; or that surrounding land does not possess special, exceptional, critical or unique characteristics that would be adversely affected by mining.

(5) Complete information in regard to subheadings (a) and (b) above has been previously submitted with an approved prospecting permit covering lands adjacent and contiguous to the present surface mining operation that would be applicable, and may be judged to still be relevant by the Department.

(6) Decker Coal Company prominently published an announcement of their application for a new permit in the Billings Gazette on June 15, 1973, and an Amended Notice on August 21, 1973. The announcement included a detailed legal description of the area of land to be affected in the permit year. Proof of publication was provided to the Department.

(7) At least thirty (30) days but not more than sixty (60) days prior to the annual renewal date of the permit, Decker Coal Company will submit an application for renewal to the Department. This application will include and the maps will show:

- (a) The exact number of acres of land affected by the operation in the current year.
- (b) The extent of backfilling and grading performed during the current permit year.
- (c) The extent of revegetative reclamation (seeding or planting) performed during the current permit year.
- (d) Any undisturbed area currently permitted but which will be disturbed during the next permit year. Decker Coal Company, in seeking to have a permit renewed, will also designate current pit spoils, roads, treatment facilities and sediment basins, and other features that will be utilized. All permit areas not renewed will be reclaimed as defined by current regulations.
- (e) Any revisions of the operating procedures as previously approved in writing by the Department.
- (f) Any other relevant information the Department may require.

(8) In all cases where a map depicting surface conditions is required, a current 7½ minute U.S. Geological Survey map or equivalent will be submitted, if available. Permit and annual report maps will be of a scale of not less than 400 feet or greater than 660 feet to the inch.

RECLAMATION

26-2.10(10)-S10300 PREPLANNING

(1) Decker Coal Company is proposing a coal mining operation of more than one year's duration and will submit intended mining and reclamation plans along with maps for the anticipated life of the operation. The intended mining and reclamation plan will be divided into two (2) time periods as determined by the Department. The intended mining and reclamation plan for the initial period will contain all requirements which would be included in the application for an annual permit. The second time period of the intended mining and reclamation plan will apply to the remaining life of the operation, (as determined at the time of application by mineral rights held either by lease, consignment or ownership). The intended mining and reclamation plans for the second period will contain in as much detail as possible the requirements of a permit application. Decker Coal Company will be obligated to conduct the method of operation and reclamation in accordance with the provisions of the plans unless proposed changes requested by the company are accepted in writing by the Department. The Department may make changes in the mining and reclamation plans when problem situations are revealed by field inspection or as other relevant information is obtained. Upon request, an aggrieved person will have an opportunity for a hearing, in accordance with Section 24 of the Act, prior to any modification of a permit or reclamation plan. As additional information and/or maps are obtained by the company for the intended area of operations such information will be promptly submitted to the Department. This rule does not repeal or otherwise modify the duty of Decker Coal Company to annually apply for a new permit and/or the renewal of an existing permit.

(2) Mine Site Resource Inventories:

Decker Coal Company secured Montana Testing Laboratories, Inc., Great Falls, Montana, to perform a soil survey and prepare a soils map to include the following:

(a) A soil survey describing all major soils being present on the area of operation and their suitability for revegetative purposes. The soil survey includes the following information:

(i) Sampling and analysis of soil horizons in sufficient detail to identify the soil types present within the area of operations and to determine the depths to which soil should be saved within each soil type. Each horizon sample will be analyzed for the following information:

- (aa) The pH.
- (ab) The salt hazard (conductivity).
- (ac) Sodium absorption ratio.
- (ad) Cation exchange capacity if the sodium absorption rate is greater than 10.
- (ae) Mechanical analyses (texture) and determinations of the percent of macro-nutrients for each soil horizon present at two or more locations within each soil type.

(ii) A soils map has been prepared on a scale of one (1) inch equals two hundred (200) feet covering the area of operation.

(aa) The soil types present and their boundaries. The operator will indicate within the various soil types the depth to which he plans on stripping topsoil.

(ab) Soil sample map locations correlated to soil type and horizon testing.

(ac) Further soil studies will be made if required by the Department. A copy of the above soil survey and soils map are included and entered as Exhibit _____.

(b) Decker Coal Company secured the Soil Conservation Service, Hardin, Montana, and also the assistance of Montana Testing Laboratories to perform a vegetative surveys as described in Section 6(3)(k) of the Act, which will include:

(i) A vegetative map acceptable to the Department which delineates community types based on two (2) or more dominant species. Dominant species are those which by their structure, number, or coverage have the greatest functional influence on the type.

(ii) A narrative describing the community types of listing associated species and discussing environmental factors controlling or limiting the distribution of species. Current condition and trend will be discussed for each community type or portion thereof if significant differences exist within a type.

(iii) The vegetative survey will be correlated with the soil survey. A copy of the vegetative surveys are included in Appendix _____.

C. MINING AND RECLAMATION PLAN

(1) Backfilling and Grading.

(a) Backfilling and grading of the disturbed area will be completed prior to removal of necessary reclamation equipment from the area of operation. If Decker Coal Company for good cause shown cannot complete backfilling and grading requirements within the time limits set for current backfilling and grading, a revised and alternate timetable of that portion only of the affected mining area will be submitted for approval by the Department.

(b) Decker Coal Company will show where the overburden and any parting strata materials are to be placed in the backfill. Materials which are not conducive to revegetation techniques, establishment, and growth will not be left on the top or within eight feet of the top of regraded spoils or at the surface of any other affected areas. It may be necessary that problem materials be placed at a greater depth if required by the Department.

(c) Decker Coal Company will bury under adequate fill all materials set forth in Section 10 (2)(a) of Chapter 325, S.L.M. 1973, only after approval of the method and site by the Department. In the event that Decker Coal Company plans to use fly-ash for fill material, it must be shown by adequate testing and analysis that the fly-ash material will not have any adverse or detrimental effect. Plans for placement of fly-ash or any other foreign material or processes in the backfill will require prior approval by the Department.

(d) Box cut spoils or portions thereof, will be hauled to the final cut if:

- (i) Excessively large areas of the mine perimeter will be disturbed by proposed methods for highwall reduction or regrading of box cut spoils, or
- (ii) material shortages in the area of the final highwall or spoil excesses in the area of the box cut are likely to preclude effective recontouring.

(e) The final grading on the area of land affected will be to the approximate original contour of the land. Where a flat surface or a surface with less slope than the original ground surface is desired, such surface will be deemed to comply with the backfilling and grading to the approximate original contour. With the exception of highwalls, railroad loops and access road cuts and fills through unmined lands, no final graded slopes will be steeper than five horizontal to one vertical (5:1) unless prior approval is secured in writing from the Department.

(f) The Department may require terracing to conserve moisture and control water erosion on all graded slopes during the process of current grading. Terraces will be installed in such a way so as not to prohibit vehicular access or revegetative procedures. Terraces will be installed at varying intervals as determined by climatic conditions, spoil and topsoil composition and texture, slope steepness, and slope length. Any surface manipulation procedures will be installed as required by the Department.

(g) Final grading will be kept current with mining operations. In order to be considered current, grading and backfilling will meet the following requirements unless an alternate plan or exceptions are granted by the Department.

- (i) On lands affected by area strip mining, the grading and backfilling will not be more than two spoil ridges behind the pit being worked; the spoil from that pit being considered the first ridge. Variances and delayed grading of a portion of the box cut spoils is requested to obtain better recontouring, drainage and reclamation. (See Appendix "_____" and Exhibit _____)

(g) (ii) Decker Coal Company does not anticipate augering for coal at this time. In the event that the operation develops into stripping and augering, the augering will follow the stripping by not more than sixty (60) days and final grading and backfilling will follow the augering by not more than fifteen (15) days, but in no instance will an area be left ungraded more than 1,500 feet behind the augering.

(iii) All backfilling and grading will be completed within ninety (90) days after the Department has determined that the operation is completed or that a prolonged suspension of work in the area will occur. Final pit reclamation will proceed as close behind the coal loading operation as the frequency and location of ramp roads, the use of overburden stripping equipment in highwall reclamation, and other factors may allow.

(iv) Grading and backfilling of other types of subject excavations will be kept current as departmental directives dictate for each set of field circumstances.

(h) Reclamation equipment that will be used in grading and highwall reduction consists mainly of dragline work with 41 cubic yard B.E. 1300, two D-9 Cat tractor dozers, and two No. 16 Cat motor patrols.

(2) Highwall reduction.

(a) All highwalls will be reduced and the steepest slope of the reduced highwall will be no greater than twenty (20) degrees from the horizontal. Highwall reduction will be commenced at or beyond the top of the highwall and sloped to the graded spoil bank. In all cases the final pit will be backfilled so as to cover all exposed coal seams with at least 4 feet of non-toxic fill material.

(b) Decker Coal Company has shown by a narrative and cross section the plan of highwall reduction including the limits of buffer zones in the Appendix _____.

(3) Buffer zones.

(a) All mining activities, including highwall reduction and related reclamation, will cease at least one hundred (100) feet from a property line, permanent structure, unmineable steep or precipitous terrain, or any area determined by the Department to be of unique scenic, historical, cultural, or other unique value.

(b) The transition from undisturbed ground will be blended with cut or fill to provide a smooth transition in topography.

(4) Roads and Railroad Loops.

(a) Haulageway roads through permitted areas will be designed so that their presence does not delay or prevent recontouring and revegetation on immediately adjacent spoils.

(b) Ramp roads will be allowed under the following criteria:

(i) No more than two (2) ramp roads per mile of active pit being mined will be allowed. The active length of the pit is 2.8 miles or 5 ramp roads allowable. The present operating pit design requires that 7 ramp roads are needed for a continuous high production and mining operation. A narrative of Decker Coal Company's mining operation explaining the urgent need for the two additional ramp roads is enclosed in the Appendix "_____".

(ii) Ramp roads, beginning from the spoil edge of the pit being worked will be engineered so as to exhibit an overall 7% grade, or steeper, until topping on graded spoils. As each new pit is excavated, the ramp roads will be regraded as soon as possible, so as to remain at an overall 7% or steeper grade from the spoil side of the new pit. In all cases, ramp road renovation grading will allow for topsoiling and revegetative activities to proceed during prime revegetative seasons. From Decker Coal Company's past coal hauling experience,

the 7% grade creates severe strain on the hauling equipment, increases fuel consumption and would cause severe safety problems during inclement weather. An alternate plan is included in Appendix _____ requesting that the present 4% grade be continued in the future ramp roads.

(c) The Department may require that access roads constructed after the effective date of the Act be graded, constructed, and maintained in accordance with certain requirements. Decker Coal Company's access roads as built, and future construction will meet the following stipulated requirements:

- (i) No sustained grade will exceed (8%).
- (ii) The maximum pitch grade will not exceed twelve percent (12%) for three hundred (300) feet.
- (iii) There will not be more than three hundred (300) feet of maximum pitch grade for each one thousand (1000) feet.
- (iv) The grade on switchback curves will be reduced to less than the approach grade and will not be greater than ten percent (10%).
- (v) Cut slopes will not be more than 2:1 in soils or 1/2:1 in rock.
- (vi) All grades referred to will be subject to a tolerance of two percent of measurement. Linear measurements will be subject to a tolerance of ten percent (10%) of measurement.

(d) The main roads and railroad loop have been previously constructed. This construction did not proceed along dry coulees and intermittent drainageways and no off-site sedimentation was created.

(e) Drainage ditches have been constructed on both sides of any through-cut, and the inside shoulder of a cut-fill section, with ditch relief cross-drains being spaced according to grade. Water has been intercepted where necessary before reaching large fills, and drained off and released below the fill. Drainage structures have been constructed across dry-run draws. No perennial streams exist in the mining area.

(f) The cut and fill slopes resulting from the construction of the access road outside of the area to be mined were stabilized and revegetated in November, 1972. The railroad loop is constructed on 1 to 1 slopes and $1\frac{1}{2}$ to 1 fill slopes consisting of a rock face (scoria) that will not support plant growth. The haulageway roads outside the area to be mined will be stabilized and revegetated the first seasonal opportunity.

(g) No roads or railroad loops will be surfaced with refuse coal, acid producing or toxic material or with any material which will produce a concentration of suspended solids in surface drainage.

(h) All appropriate methods will be employed by Decker Coal Company to prevent loss of haulage or access road surface material in the form of dust.

(i) Upon abandonment of any road or railroad loop, the area will be conditioned and seeded and adequate measures taken to prevent erosion by means of culverts, water bars, or other devices. Such areas will be abandoned in accordance with all provisions of Chapter 325, Session Laws of Montana, 1973, and MAC 26-2.10(10)S-10330 and MAC 26-2.10(10)-S10340 of the Rules and Regulations adopted pursuant thereto. Upon completion of mining and reclamation activities, all roads will be closed and reclaimed unless the landowner requests in writing and the Department concurs that certain roads of specified portions thereof are to be left open for further use.

STATE LANDS

26-2.10(10)-S10320 BLASTING

(1) Decker Coal Company in conducting a mining operation will comply with all state and federal regulations regarding the blasting and handling of explosives.

(2) The blasting regulations contained herein apply to overburden blasting operations and to other operations as the Department may determine.

(3) Where blasting operations will be conducted on a mining site, a permanent sign will be erected near the entrances to the mining operation and be plainly visible. The sign will be a minimum of four feet square with the words "Warning Blasting Area" in letters not less than seven (7) inches in height upon a background of contrasting colors.

(4) All blasting will be scheduled.

(5) Blasting will not be conducted during hours of darkness, except in emergency situations such as those posed by approaching thunderstorms.

(6) All holes primed will be blasted within seventy-two (72) hours.

(7) When conducting blasting operations, Decker Coal Company will notify all adjacent residents within a one (1) mile radius in writing, by hand or by U. S. mail that blasting will occur at certain times of the day. Adequate measures will be taken to insure the safety of anyone near the blasting area prior to a blast.

(8) All roads in the blast area will be guarded against unauthorized entry at least ten (10) minutes prior to the blast to insure that no one except authorized personnel are in the area. Suitable precautions for entry after a blast will be taken in the event of misfire or unusual circumstances.

(9) Audible warning signals will be used.

(10) All employees on the area of land affected will be notified of the blast signals. In addition, blast signals will be conspicuously posted at all entrances to the mine area.

(11) Designated employees, hereinafter called the blasters, will be in charge of blasting operations, and they will supervise the fixing of all charges and all blasting operations.

(12) One individual other than the blaster will be near the blast area, stationed at a safe distance, within view of the blaster and within contact of the blasters. He will be responsible for blast signals.

(13) Any person conducting blasting operations will take particular cognizance of any public or private facilities, active underground mines, liquid disposal wells, gas or oil wells, water wells, waterways, public or private water storage facility, or transmission lines in the blast area and shall take appropriate steps to preclude damage to those facilities.

(14) All operators or their certified blasters will keep a log describing each blast. The following information will be required:

- (a) The company name;
- (b) The location, date and time of blast;
- (c) The type of material blasted;
- (d) The type of explosive;
- (e) The diameter of the blast holes;
- (f) The number and depth of the holes;
- (g) A description of the stemming;
- (h) The shooting pattern of the blast, including information on maximum weight of charge per hole, per delay, and the burden spacing of the holes, and the type of initiation system.

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(15) Every effort will be made to minimize noise effects from blasting.

(16) Every effort will be made to minimize the off-site damage occurring from the concussion or vibration effects of blasting.

(17) Notwithstanding any other regulation, blasting will not be done in such a manner as to eject debris onto adjacent property outside the permit area or so as to constitute a hazard or endanger or damage persons or property.

(1) Decker Coal Company will comply with the following requirements and with all applicable water quality standards established under Montana law and the rules adopted pursuant thereto.

(a) Non-degradation of waters. Waters within the public domain of the state that possess a higher quality than that established on the effective date of established standards will be maintained at their present high quality consistent with the powers granted to the Board. Such high quality waters will not be lowered in quality unless and until it is affirmatively demonstrated to the Board through public hearing, that such a change is justifiable as a result of necessary economic or social development and that the change will not adversely affect the present and future uses of such water. In implementing this policy as it relates to interstate streams, the Administrator of the Environmental Protection Agency will be provided with such information as will enable the Administrator to discharge his responsibilities under the Federal Water Pollution Control Act.

(b) Impound and Treatment.

(i) Treatment facilities in sufficient size and number consisting of but not limited to collection basins, water retarding structures and siltation dams will be constructed with prior approval of the Department. All such facilities will be constructed at or above the points of discharge into receiving streams for the purpose of treating acid or toxic water and for the settling of sediment prior to discharge into the receiving stream. As part of an application for permit, Decker Coal Company will submit the design specifications, drawings method of operation and control, and quality of discharge of the treatment facilities. Decker Coal Company will indicate on the maps submitted as part of an application for permit the proposed location of all treatment facilities. Proposed reclamation of treatment facilities will be included in the reclamation plan.

(ii) Additional treatment facilities may be required by the Department after commencement of the operation if conditions arise that could not be anticipated at the time of the permit application.

(iii) All approved and constructed treatment facilities will be maintained in proper working order by the Decker Coal Company and operated so that they will perform as proposed in the application for permit. All treatment facilities constructed and approved pursuant to the provisions of this rule will be monitored by Decker Coal Company to assure continuous satisfactory performance until approved reclamation has been accomplished.

(iv) Permanent water impoundments will not be allowed unless approved by the Department. If the Department determines at any time that a permanent impoundment area will not fill to expected levels, meet acceptable water quality standards or any other relevant criteria, the impoundment area will be regraded and surface drainage facilitated.

(v) No water quality treatment of approved lakes or ponds will be permitted without Department approval.

(vi) Monthly monitoring reports, where applicable, will be submitted to the Department including the number of operating days, the gallons of drainage treated, a log of the tests made in accordance with Subsection (c) of this Rule, and a description of any operating problems and the corrective action taken.

(vii) Decker Coal Company will by the treatment of all runoff water prevent the drainage into the waters of the state drainage from any source, the pH of which is less than 6.0 or greater than 9.0, or which contains a concentration of iron in excess of seven (7) milligrams per liter (mg/l). The discharge must register positive net alkalinity (total alkalinity must exceed the total acidity) and the turbidity shall not exceed 100 J.C.U. The Department may modify above requirements if special problems occur.

(viii) The maximum total allowable increase to naturally occurring stream turbidity is ten (10) Jackson Candle Units except that four (4) hours following a major precipitation event, the discharge shall not contain suspended sediments in excess of five hundred (500) Jackson Candle Units above normal twenty-four (24) hours thereafter. All analyses are to be defined and performed according to the Standards Methods for the Examination of Water and Wastewater, unless otherwise specified in writing by the Department. If the above standards in (vii) and (viii) are in conflict with Federal and/or other Montana state agencies the more stringent regulations will apply.

(c) Drainage.

(i) All surface water which might damage regraded slopes or drain into the stripping pit will be intercepted on the uphill side of the highwall or other mine perimeters by diversion ditches and conveyed by stable channels or other means to natural or prepared watercourses outside the operation unless it is determined by the Department that such ditches and channels are unnecessary or would create a more serious pollution problem. Such conveyances will be of sufficient size and grade to prevent overflow into the mine area. If the ditches are likely to carry surface water only intermittently, they will be retopsoiled and revegetated with grasses, forbs and/or legumes. All constructed diversion ditches will be included in the permit acreage and shown on the map.

(ii) Water accumulating in the course of the operation will meet the water quality specifications enumerated herein or will be pumped or siphoned to a treatment or settling facility prior to discharge into a natural drainway. Under no circumstances will water be discharged onto highly erodable soil or spoil banks.

(iii) There are no existing deep mine workings within the permit area.

(iv) All drainage from the active mine area will exit through impoundment or treatment facilities in accordance with Subsection (b) (i) of this Rule.

Decker Coal Company has constructed a sump located in the lower end of the scraper pit and coal vein adjacent to the railroad grade. Two 8-inch electric pumps are installed, one each in two 60-inch diameter corrugated metal pipe. The pumps are actuated by float control mechanism. The pumps discharge into a sedimentation area. This sediment area was created by installing a stand pipe at the inlet of a 54-inch diameter C.M. pipe under the railroad and highway grade. The water elevation is raised about 18 feet above the flow line of the drainage pipe giving any dirt or silt a chance to settle out.

The mine waste water from the outlet of the 54 inch diameter C.M. pipe flows into an old river channel and eventually empties into Tongue River, a distance of approximately 1500 feet.

An average daily flow is estimated at 100 gallons per minute, but this quantity fluctuates because a 12-inch pump and water truck loading facilities are set up in this settling pond area and used for watering-down haul road, etc. for dust control.

A waste water discharge, untreated groundwater Permit No. 67-W dated March 17, 1972, and renewed January 1, 1973, was obtained from the State Board of Health and Environmental Sciences.

Samples of waste water at discharge point have been taken and the chemical analyses, as requested, have been submitted monthly to the Water Pollution Control Section, Montana State Department of Health, Helena, Montana.

A sketch map of this area and a recent copy of the water analysis is enclosed in Appendix "_____".

STATE LANDS

26-2.10(10)-S10340 TOPSOILING

(1) All available topsoil will be removed from the area of land affected before further disturbance occurs. Topsoil removal will precede each step of the mining operation. The Decker Coal Company will indicate in the reclamation plan the equipment and method used in topsoil salvage and redistribution.

(2) Stockpiles of salvaged topsoil will be located in an area where they will not be disturbed by ongoing mining operations and will not be lost to wind erosion or surface run-off. All unnecessary compaction and contamination of the stockpiles will be eliminated and once stockpiled the topsoil will not be rehandled until replaced on regraded disturbances. The Department may require immediate planting of an annual and/or perennial crop on topsoil stockpiles for the purposes of stabilization. Stockpile locations will be indicated on the map submitted as part of an application for a permit.

(3) Stockpiled topsoil will be replaced on all areas to be seeded within a ninety (90) day period prior to revegetative seeding or planting. Extreme care will be exercised to guard against erosion during application and thereafter. In the case of abandoned roads, the roadbeds will be ripped, disced, or otherwise conditioned before topsoil is replaced. The Department may prescribe additional alternate conditioning methods for the reclamation of abandoned roadbeds.

(4) If necessary, redistributed topsoil will be reconditioned by discing, ripping, or other appropriate methods. Gypsum, lime, fertilizer, or other amendments may be added in accordance with MAC 26-2.10(10)-S10350, and/or as stated in the approved reclamation plan.

(5) Spoil surfaces will be left roughened in final contour grading to eliminate slippage zones that may develop between deposited topsoil and heavy textured spoil surfaces. Decker Coal Company will take all measures necessary to assure the stability of topsoil on graded spoil slopes.

(6) Any application for permit or accompanying reclamation plan which for any reason proposes to use materials other than or along with topsoil for final surfacing of spoil or other disturbances will document problems of topsoil quantity or quality. The application or plan will also show that the topsoil substitute(s) proposed:

(a) Will not contribute to or cause pollution of surface or underground waters;

(b) Will support a diverse cover of predominantly native perennial species equivalent to that existant on the site prior to any mining related disturbances.

26-2.210(10)-S10350 PLANTING AND REVEGETATION

(1) A suitable permanent diverse vegetative cover capable of meeting the criteria set forth in Section 12 of Chapter 325, Session Laws of Montana, 1973, will be established on all areas of land affected except traveled portions of railroad loops and roadways or areas of authorized water confinement. Areas will be planted or seeded during the first appropriate season following completion of grading, topsoil redistribution and remedial soil treatments.

(2) Decker Coal Company will establish a permanent diverse vegetative cover of predominantly native species by drill seeding method.

(3) Decker Coal Company will utilize locally grown genotypical seed and seedlings when available in sufficient quality and quantity.

(4) Decker Coal Company will plant seed of a pure and viable nature. Unless otherwise approved by the Department, seed will be at least 90% pure. Seeding rates will reflect germination percentages.

(5) Decker Coal Company will consider soil, climate, and other relevant factors when planting and/or seeding to provide for the best seed germination and plant survival.

(6) All drill seeding will be done on the contour. When grasses, shrubs and/or forbs are seeded as a mixture they may be drill seeded in separate rows at intervals specified in the standards Soil Conservation Service (SCS) planting guidelines. Such mixed seedings will be done in this manner wherever necessary to avoid deleterious competition of different vegetal types or to avoid seed distribution problems due to different seed sizes.

(7) Soil amendments will be used as necessary to supplement the soil and to aid in the establishment of a permanent vegetative cover as specified in the approved reclamation plan or as later deemed necessary by the Department.

(8) Decker Coal Company will use any other means necessary to insure the establishment of a diverse and permanent vegetative cover, including but not limited to irrigation, and fencing or other protective measures.

(9) The Department may require the seeding of annual grasses and/or legumes on such areas as it deems necessary.

(10) Mulch will be immediately applied to all areas that do not have permanent or temporary cover established when, in the opinion of the Department, the grade or length of any slope presents a likelihood of substantial erosion or substantial deposition of sediment into any waters of the state.

(11) The Department will annually inspect seeded areas at the end of the growing season to determine species diversity, germination, and seedling take. If the Department determines that seedings are unsuccessful in terms of good germination and/or seedling take, immediate investigative action will be taken by Decker Coal Company at the request of the Department to determine the cause so that alternatives can be employed to establish the desired permanent vegetative cover at the very next seasonal opportunity. The investigative report will be submitted along with prescribed course of corrective action prior to the next growing season.

(12) If the area affected is to be primarily utilized by domestic stock, the Department may require incorporation of a grazing system after vegetative establishment to gauge stand tolerance to grazing pressure.

REGRADED DISTURBED SURFACE TREATMENT PLAN
(To accompany Decker Coal Company's Application for Surface Mining
Permit, pursuant to Chapter 325, Session Laws of Montana, 1973)

Topsoil Disposition

(1) The plan of operation is to advantageously use the top soil within the mine area for placement on spoil banks for revegetation purposes. Topsoil depth varies from a few inches in upland terrain (ridge tops) to several feet in swales or depressions. If the soil contains any root or other organic material, it is worthwhile saving. It is evident that all available topsoil must be removed and stockpiled in readiness for use in revegetation of spoil banks. The topsoil, clayey soils and shale, will be examined and tested for toxic materials in advance and during the stripping operation and the better materials left on the surface for revegetation. Even though it is intended to use a large dragline as a primary stripping unit, which will make stockpiling and re-use of top soil difficult, additional equipment will be provided to accomplish this end. Self-loading scrapers and tractor type bulldozer will be dedicated to the recontouring and topsoiling of the dragline spoil banks. This, of necessity, will ameliorate the steepness of the dragline spoil bank slopes so that the grading equipment can traverse them. The soil materials that are utilized for placement on disturbed areas, after the completion or termination of the mining operations, will be at a depth sufficient for plant growth on all areas to be seeded after final grading.

(2) The adjacent land to the Decker mining operation is presently being used year-round for pasture or grazing, depending on the weather conditions. It is the intent to reclaim this mined area for this specific purpose with subordinate use as wildlife shelter and forage areas. An agreement was executed in 1971, between the Montana Agricultural Experiment Station and the Decker Coal Company, to provide for laboratory and greenhouse testing of soil and plant types so that a workable reclamation scheme will:

- (a) Establish desirable vegetation on the mine area;
- (b) provide habitat, food, water and protection to various forms of wildlife;
- (c) maintain and enhance water, soil and air quality, and
- (d) preserve, restore and enhance natural beauty.

We have also entered into an agreement with the Big Horn Conservation District and will cooperate with them in the preparation and implementation of a reclamation plan. A copy of the Cooperative Agreement is enclosed.

In September 1971, a soil study of the coal mine overburden was performed by Montana Agricultural Experiment Station to determine the texture and the chemical analyses of the various strata. A variety of grass species were planted in the north spoil bank, adjacent to a test pit that was opened in September 1970, to secure a large sample of coal. From a previous soil study, it was known that the soil conditions were marginal towards supporting plant growth because some of the spoil bank areas were topsoiled and some areas were not. The percentage of survival and growth of all species were not acceptable. It was evident that all available top soil must be removed and salvaged for future use in revegetation of spoil banks.

During the week of October 16, 1972, the U. S. Department of Agriculture, Forest Service, Forestry Sciences Laboratory, Logan, Utah, installed a very scientific grass seeding research project. This study has two primary objectives, namely, (1) determine

the minimum combination of treatments necessary to receive an acceptable stand of grass, shrubs, and trees (treatments refer to fertilization, topsoiling, watering and soil mulching), and (2) to assess the short and long-term merits of grass mixtures consisting of (a) all introduced grasses, (b) all native grasses, and (c) native plus introduced grasses. A list of the different grass species plots and special grass seed mixtures used is attached.

As our mining operation just started last August 1972, there will be sufficient time elapse for both of these research projects to develop and come up with the right answer before permanent revegetation will take place on leveled or sloped spoil banks.

Seeding

(3) As mentioned above, the results of these programs will be utilized to determine the exact plant mixture and fertilizer requirements. In the absence of data from the current study, we submit the following seeding plan:

Seed mixture:	Green Needlegrass)	
	Western wheatgrass)	mixed and seeded 15 lbs./acre
	Slender wheatgrass)	
Fertilizer:	16-20-0	200 lbs./acre

It is re-emphasized that test work currently in progress may be utilized to modify or improve this plan as soon as data becomes available.

Successful seeding can be done in both spring and fall. The preferable months are generally April and October-November. If the first seeding for vegetation cover is not completely successful, measures will be taken until an acceptable vegetation growth is established. A conscientious effort will be made to revegetate the disturbed areas as promptly as possible, consonant with the conduct of the mining operations.

The following maps and reports pertaining to the soils survey of the mine area, overburden spoilbanks, are enclosed and entered as Exhibit _____:

1. Mining layout map prepared by Decker Coal Company showing the actual areas that topsoil removal and salvage has taken place ahead of the drill and shoot and dragline operation, and the location of the top soil piles in the mine area.
2. Coal Mine Land Reclamation Research Report 21-April 1972 located at Decker, Montana and prepared by R. L. Hodder and B. W. Sindelar, Research Associate.
3. Soil and Capability Map prepared by Soil Conservation Service-U. S. Department of Agriculture, Big Horn Conservation District.

INFORMATION IN RESPONSE TO REQUIREMENTS SPECIFIED IN CHAPTER 325,
M.S.L. 1973, SENATE BILL NO. 94

(To accompany Decker Coal Company's Application for Surface Mining Permit pursuant to Chapter 325, Session Laws of Montana, 1973.)

Section 6. (1) Decker Coal Company has applied for a new permit in accordance with MAC 26-2.10(10)-S10270 of the Rules and Regulations, Chapter 325, Session Laws of Montana. We will be in compliance with the requirements of this Act and the rules and reclamation plan in Section (10) of this Act.

(2) Decker Coal Company has filed an application that contains a complete and detailed plan for the mining, reclamation, revegetation and rehabilitation of the land and water to be affected by the operation. Such plan reflects thorough advance investigation and study by Decker Coal Company and includes all known or readily discoverable past and present uses of the land and water to be affected and the approximate periods of such use and will state:

(a) The Decker mining operation is situated in the SE $\frac{1}{4}$ Sec. 8; S $\frac{1}{2}$, NE $\frac{1}{4}$ Sec. 9; Part s $\frac{1}{2}$ Sec. 10; Part Sec. 15; Section 16; N $\frac{1}{2}$, SE $\frac{1}{4}$ Sec. 17; N $\frac{1}{2}$, N $\frac{1}{2}$ SW $\frac{1}{4}$ Sec. 21, and the NW $\frac{1}{4}$ Sec. 22, all in T. 9 S., R. 40 E., M.P.M., consisting of 2,725 acres, more or less.

The total mineable area of land affected by strip mining contains 1500 acres, more or less; of the remaining 1225 acres, 107 acres are utilized for facilities, railroad loop, roads and equipment work areas used in the process of producing and removing the coal, and the remaining 1118 acres will be undisturbed. Reference is made to Exhibit _____ enclosed showing mine location and area.

(b) The owners of record of the surface of the area of land to be affected by the permit are Decker Coal Company, P. O. Box 746, Sheridan, Wyoming 82801, and State of Montana, Department of State Lands, Helena, Montana 59601.

The owners of record of all surface area adjacent or within one-half (.5) mile of any part of the affected area are:

1. Emmett and Vada L. Munson, Decker, Montana
2. Pacific Power & Light Company, Public Service Bldg., Portland, Oregon
3. Westmoreland Resources, P. O. Box 1883, Billings, Montana 59103
4. Montana Department of Natural Resources and Conservation, Helena, Montana
5. Montana State Highway Department, Helena, Montana
6. Willis W. Elder, Decker, Montana
7. Lawrence Thomas and Marilyn Thomas, c/o Mansel Johnston and
Thelma Johnston, Decker, Montana
8. Big Horn County, Hardin, Montana
9. State of Montana, State Land Department, Helena, Montana

(c) The present owners of record of all subsurface minerals in the land to be affected are State of Montana, Board of Land Commissioners, Capitol Building, Helena, Montana, and Bureau of Land Management, 316 North 26th Street, Billings, Montana 59101.

(d) Decker Coal Company's legal right to mine the mineral on the land affected by the permit is covered by valid and producing Federal Lease No. 057934-A and Montana State Leases No. C-1062-71 and C-527-63.

(e) The permanent post office address is Decker Coal Company, P.O. Box 746, Sheridan, Wyoming 82801. The field office address is Decker Coal Company, P.O. Box 12, Decker, Montana 59025.

(f) Decker Coal Company nor any associated company have held any other permits under this Act.

(g) Decker Coal Company or any associated company have never had a strip mining license or permit issued by any other state or federal agency revoked, or have ever forfeited a strip mining bond or a security deposited in lieu of a bond.

(h) Decker Coal Company does not have any persons engaged in strip mining activities on their behalf.

(i) The annual rainfall in the vicinity of Decker, Montana (Birney station) records 15.44 inches in Climatological Data published by U.S. Dept. of Commerce, Montana Annual Summary 1972, Volume 75 No. 13. The prevailing wind direction is from northwest at an average velocity of 8.0 miles per hour, as obtained from the Recorded Forecasts and Readings at Sheridan County Airport.

(j) Between the years of 1966 and 1970, numerous drill holes have been logged in the mine area. The nature and depth of the various strata and topsoil have been recorded. Exhibit _____ indicates the location of the groundwater control and/or research wells drilled by Decker Coal Company. These wells were drilled for the sole purpose of a groundwater study and report by the Montana State Bureau of Mines, sponsored by Wayne Van Voast.

The aquifer that is encountered in the coal mining operation is known as the D₁ aquifer. This aquifer is located near the bottom of the coal vein percolating through the coal and stops on the impervious shale rock. The well located at the Montana Club would be classified as a domestic well located in the D₁ aquifer. The enclosed layout map shows the location of the Montana Club. This domestic well is too far away from the mining operations to be affected at this time. From the continuous recording of the static water elevation in the wells in the affected area, any adverse effect to the domestic or stock wells will be known far in advance. The ground control wells that were drilled around the perimeter of the affected land produce from 12 to 25 gallons per minute. With this small amount of available water, a minimum or practically no radial draw-down would occur. A copy of the ground water quality analysis performed by the Montana Bureau of Mines and Geology is enclosed for additional information.

Further, Decker Coal Company secured from the State Board of Health and Environmental Sciences, Permit No. 67-W covering waste water discharge, untreated groundwater near Decker, Montana. Samples of groundwater at discharge point have been taken and chemical analyses submitted monthly to the Water Pollution Control Section, State of Montana, Department of Health, Helena, Montana. A copy of the chemical analyses of the water samples have always been forwarded to the Department of State Lands, Helena. A recent copy of the water analysis is enclosed for reference.

The results of certain trace element analyses of Montana Coals Sampled in June, 1972, is enclosed. See copy of letter dated March 19, 1973 from State Department of Health and Environmental Sciences, Helena, Montana, to Decker Coal Company, and results of Commercial Testing and Engineering Co. of coal sample submitted by Decker Coal Company May 10, 1973. Copies of the above reports are included in Appendix _____.

All samplings and analyses of soils, topsoil and subsoils, have already been mentioned in MAC 26-2.10(10)-S10300 Rules and Regulations.

Two (2) copies each of two (2) sets of geologic cross-sections accurately depicting the known geologic makeup beneath the surface of the affected land have been submitted with the permit application. Exhibit _____. The cross-sections are at 500-foot intervals and are perpendicular to each other. They depict the thickness and geological character of all known strata.

(k) A daily newspaper of general circulation within Big Horn County that would be used for published announcements of an application towards strip mining permits is the Billings Gazette, Billings, Montana.

(3) (a) - (e) Information requested in (a) through (e) of the Act are shown on the mining map designated as Exhibit _____.

(f) A map has been prepared showing the drainage plan on and away from the area of land affected. This plan will indicate the directional flow of water, constructed drainways, natural waterways used for drainage, and the streams or tributaries receiving the discharge, Exhibit _____.

(g) thru (j) Information requested in the Law shown on Exhibit _____.

(k) Information requested in the Law shown on Exhibit _____.

(l) All maps submitted will be signed and notarized.

(m) The maps will contain such other or further information as the Department may require.

(4) Reference is made to MAC 26-2.10(10)-S10310, Rules and Regulations.

(5) An application fee of fifty dollars (\$50) will be paid. Decker Coal Company has filed with the Department a bond payable to the State of Montana with surety satisfactory to the Department in the penal sum to be determined by the Board (on the recommendation of the Commissioner) of not less than two hundred dollars (\$200) nor more than twenty-five hundred dollars (\$2,500) for each acre or fraction thereof of the area of land affected, with a minimum bond of two thousand dollars (\$2,000), conditioned upon the faithful performance of the requirements set forth in this Act and of the rules of the Board. In determining the amount of the bond within the above limits, the Board will take into consideration the character and nature of the overburden, the future suitable use of the land involved, and the cost of backfilling, grading, highwall reduction, topsoiling, and reclamation to be required; but in no event will the bond be less than the total estimated cost to the state of completing the work described in the reclamation plan.

Section 7. The Department may increase or reduce the area of land affected by an operation under a permit on application by an operator, but an increase may not extend the period for which an original permit was issued. Decker Coal Company may, at any time within one (1) year from the date of issuance of the permit, apply to the Department for an amendment of the permit so as to increase or reduce the acreage affected by it. The Decker Coal Company will file an application and map in the same form and with the same content as required for an original application under this Act and will pay an application fee of fifty dollars (\$50) and will file with the Department a supplemental bond in the amount to be determined under Section 6 for each acre or fraction of an acre of the increase approved. If the Department approves a reduction in the acreage covered by the original or supplemental permit, it will release the bond for each acre reduced, but in no case shall the bond be reduced below two thousand dollars (\$2,000), except as provided in subsection (5) of Section 6.

Section 8. Not applicable to Decker Coal Company's application because all coal prospecting and exploratory work was completed prior to the beginning of coal mining operation.

Section 9. Informational data to be approved by the Department.

Section 10. (1) As rapidly, completely, and effectively as the most modern technology and the most advanced state of the art will allow, Decker Coal Company will reclaim and revegetate the land affected by its operation. Under the provisions of this Act and rules adopted by the Board, Decker Coal Company will prepare and carry out a method of operation, plan of grading, backfilling, highwall reduction, topsoiling and a reclamation plan for the area of land affected by their operation. In developing a method of operation, and plans of backfilling, grading, highwall reduction, topsoiling and reclamation, all measures will be taken to eliminate damages to landowners and members of the public, their real and personal property, public roads, streams and all other public property from soil erosion, landslides, water pollution, and hazards dangerous to life and property. The reclamation plan has set forth in detail the manner in which we intend to comply with this section and Sections 11, 12 and 13 of this Act.

(2) In addition to the method of operation, grading backfilling, highwall reduction, topsoiling and reclamation requirements of this Act and rules adopted under this Act, Decker Coal Company, consistent with the directives of subsection (1) of this section will:

(a) bury under adequate fill all toxic materials, shale, mineral, or any other material determined by the Department to be acid producing, toxic, undesirable, or creating a hazard;

(b) seal off, as directed by rules, any breakthrough of water creating a hazard;

(c) impound, drain, or treat all runoff water so as to reduce soil erosion, damage to grazing and agricultural lands, and pollution of surface and subsurface waters;

(d) remove or bury all metal, lumber, and other refuse resulting from the operation;

(e) use explosives in connection with the operation only in accordance with Department regulations designed to minimize noise, surface damage to adjacent lands and water pollution, ensure public safety, and for other purposes.

(3) Decker Coal Company will not throw, dump, pile or permit the dumping, piling, or throwing or otherwise placing any overburden, stones, rocks, mineral, earth, soil, dirt, debris, trees, wood, logs or any other materials or substances of any kind or nature beyond or outside of the area of land which is under permit and for which a bond has been posted under Section 6, or place the materials described in this section in such a way that normal erosion or slides brought about by natural physical causes will permit the materials to go beyond or outside of the area of land which is under permit and for which a bond has been posted under Section 6.

Section 11 - Requirements: Covered in MAC 26-2.10(10)-S10310 and MAC 26-2.10(10)-S10340 Rules and Regulations.

Section 12. After the operation has been backfilled, graded, topsoiled, and approved by the Department, Decker Coal Company will prepare the soil and plant such legumes, grasses, shrubs and trees upon the area of land affected as are necessary to provide a suitable permanent diverse vegetative cover capable of:

(a) feeding and withstanding grazing pressure from a quantity and mixture of wildlife and livestock at least comparable to that which the land could have sustained prior to the operation;

(b) regenerating under the natural conditions prevailing at the site, including occasional drought, heavy snowfalls, and strong winds; and

(c) preventing soil erosion to the extent achieved prior to the operation.

The seed or plant mixtures, quantities, method of planting, type and amount of lime or fertilizer, mulching, irrigation, fencing, and any other measures necessary to provide a suitable permanent diverse vegetative cover shall be defined by rules of the Board.

Section 13. Decker Coal Company will commence the reclamation of the area of land affected by its operation as soon as possible after the beginning of strip mining of that area in accordance with plans previously approved by the Department. Those grading, backfilling, topsoiling, and water management practices that are approved in the plans will be kept current with the operation as defined by rules of the Board and a permit or supplement to a permit may not be issued, if in the discretion of the Department, these practices are not current.

Section 14. Planting requirements furnished under MAC 26-210(10)-S10350 Rules and Regulations.

Section 15. All legumes, grasses, shrubs, and trees which are planted or seeded on the area of land affected as required by this Act or rules adopted under this Act, become the property of the landowner, after complete release of the bond, unless Decker Coal Company and the landowner agree otherwise.

Section 16. Within sixty (60) days after each date of expiration of a permit, Decker Coal Company will annually file with the Department a report stating the exact number of acres of land affected by the operation, the extent of the reclamation already accomplished by Decker Coal Company, and any other information required by the rules of the Department and the Board. The report will be accompanied by a copy of the map filed with the original application which will show any revisions made necessary by results of the operation.

4 DESCRIPTION OF THE REGIONAL AREA

4. DESCRIPTION OF THE REGIONAL ENVIRONMENT

4.1 Definition of the Regional Area

For the purposes of this study, the regional environment is considered to be approximately coterminous with the Decker-Birney study area as shown in Figure 4. The Decker-Birney Study, initiated in May 1972 as a joint effort of the Bureau of Land Management (BLM) and the State of Montana, is a comprehensive multi-resource analysis directed toward development of more efficient management guidelines. (Information contained within this section is largely drawn from this source unless otherwise indicated.) The planning unit basically encompasses the drainages of the Tongue River, Otter Creek and Rosebud Creek and includes portions of Big Horn, Powder River and Rosebud Counties, Custer National Forest, and the Miles City (BLM) District.

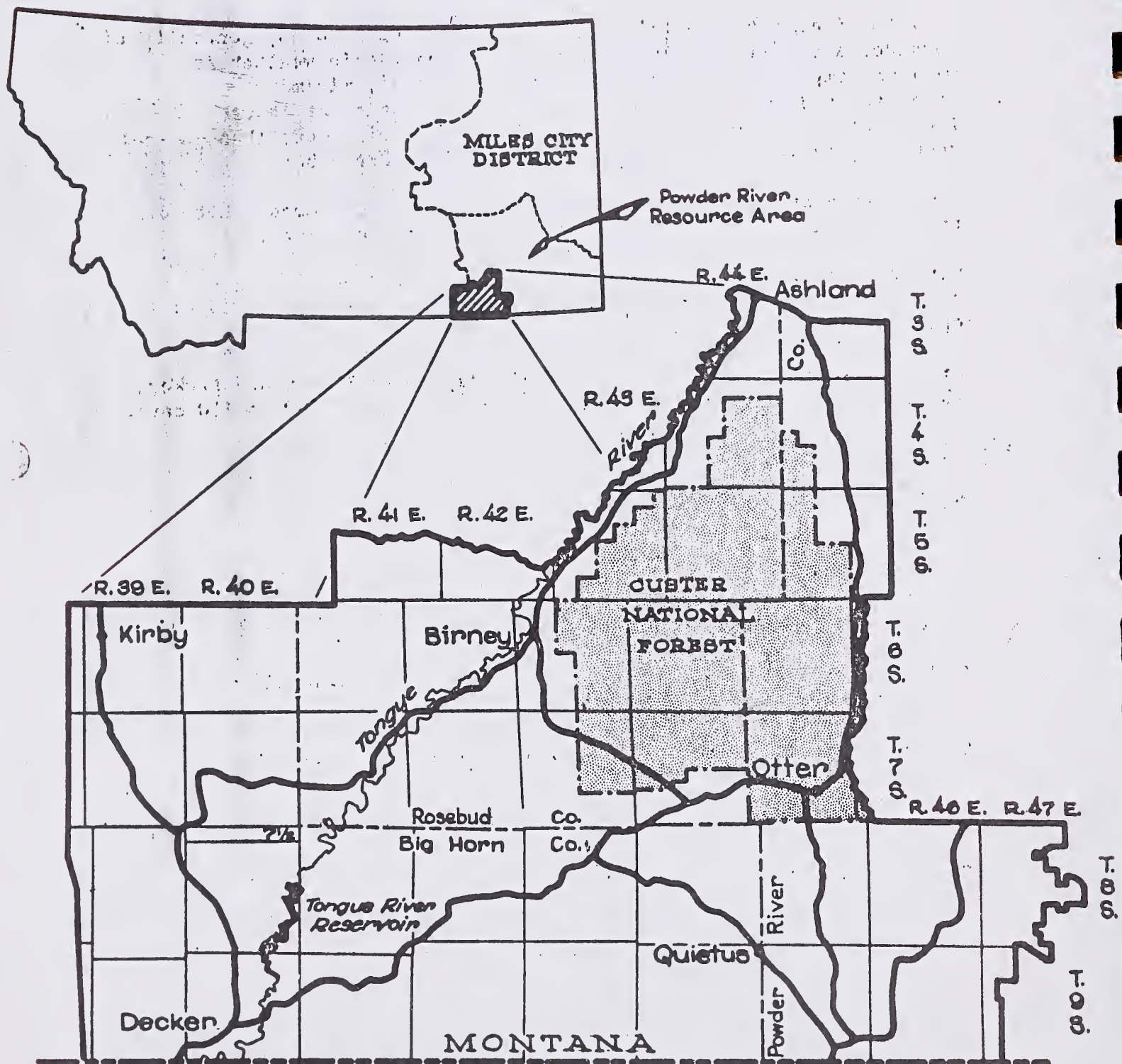
4.2 Vegetation

Five major vegetative associations, or groups of species normally occurring together, are found in the regional area (see Figure 5). In addition to the types within the various associations described below, some areas in each association are devoted to agricultural use.

1. Big Sagebrush-Shrub Association is most widespread, occurring throughout the entire region, and occupies the largest area, primarily at low to middle elevations. Major species types include big sagebrush, grass, deciduous shrubs and greasewood.

2. Grassland Association, which occurs primarily on upland plateaus and divides, consists primarily of five types: grass, grass-forb, cheatgrass, creek bottom and grass-shrub.

FIGURE 4 DECKER - BIRNEY LOCATION MAP



Source: Summary: Decker-Birney Resource Study, 1972.

FIGURE 5

REGIONAL VEGETATION MAP DECKER - BIRNEY PLANNING UNIT

Legend

Pine-woodland

Ponderosa pine

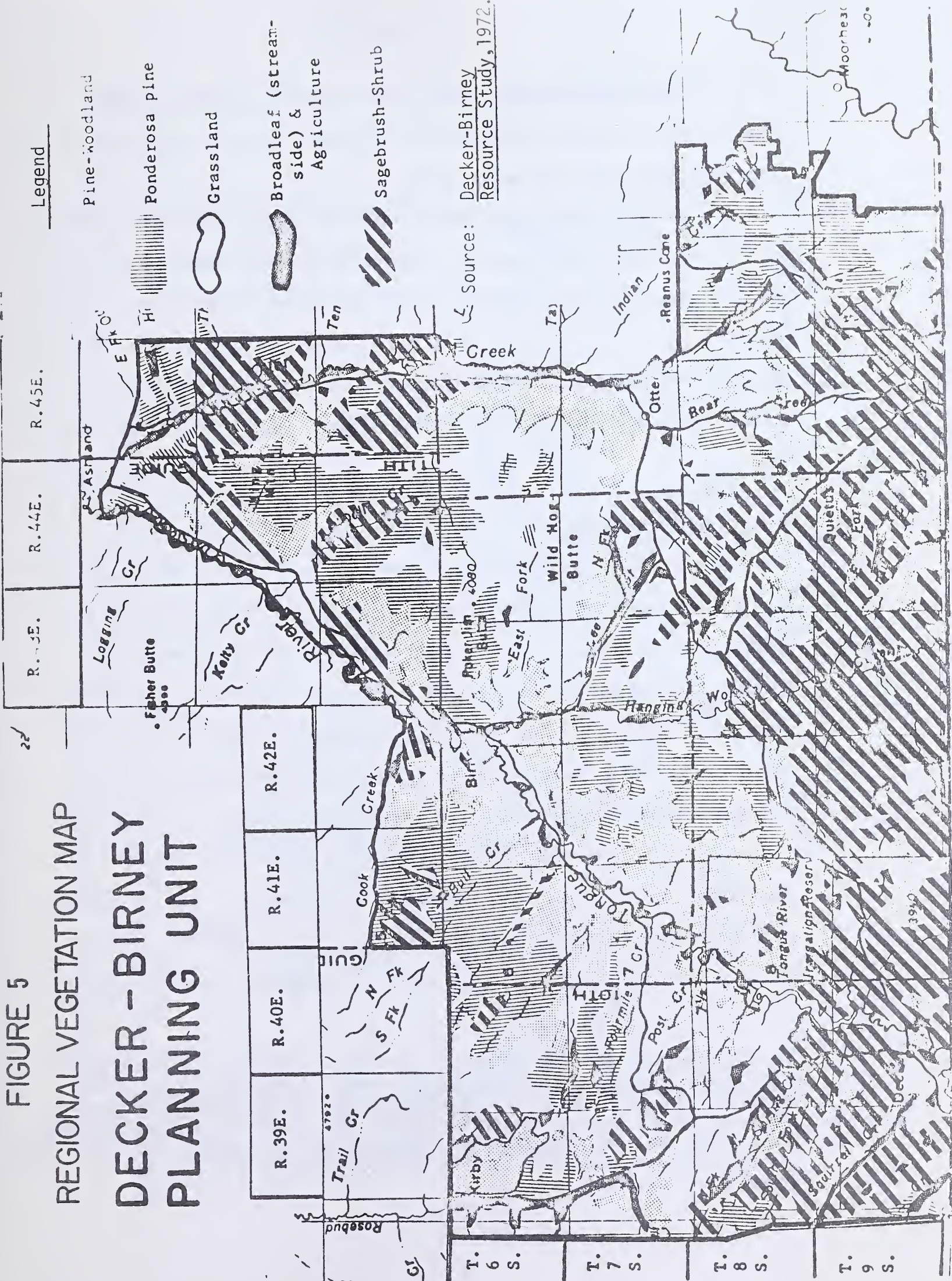
Grassland

Broadleaf (stream-
side) &
Agriculture

Sagebrush-Shrub

Source:

Decker-Birney
Resource Study, 1972.



3. Pine Woodland Association, which usually is found on rocky, steep southern exposures, includes pine-juniper, juniper, sagebrush-grassland, rhus and creek bottom types.

4. Ponderosa Pine Association occurs on north, west and southwest facing slopes and throughout long narrow valleys. Species types include ponderosa pine, grassland park, sagebrush park, pine-rhus and juniper.

5. Broadleaf Association is found primarily along perennial streams and consists of cottonwood, box elder-ash and silver sagebrush types.

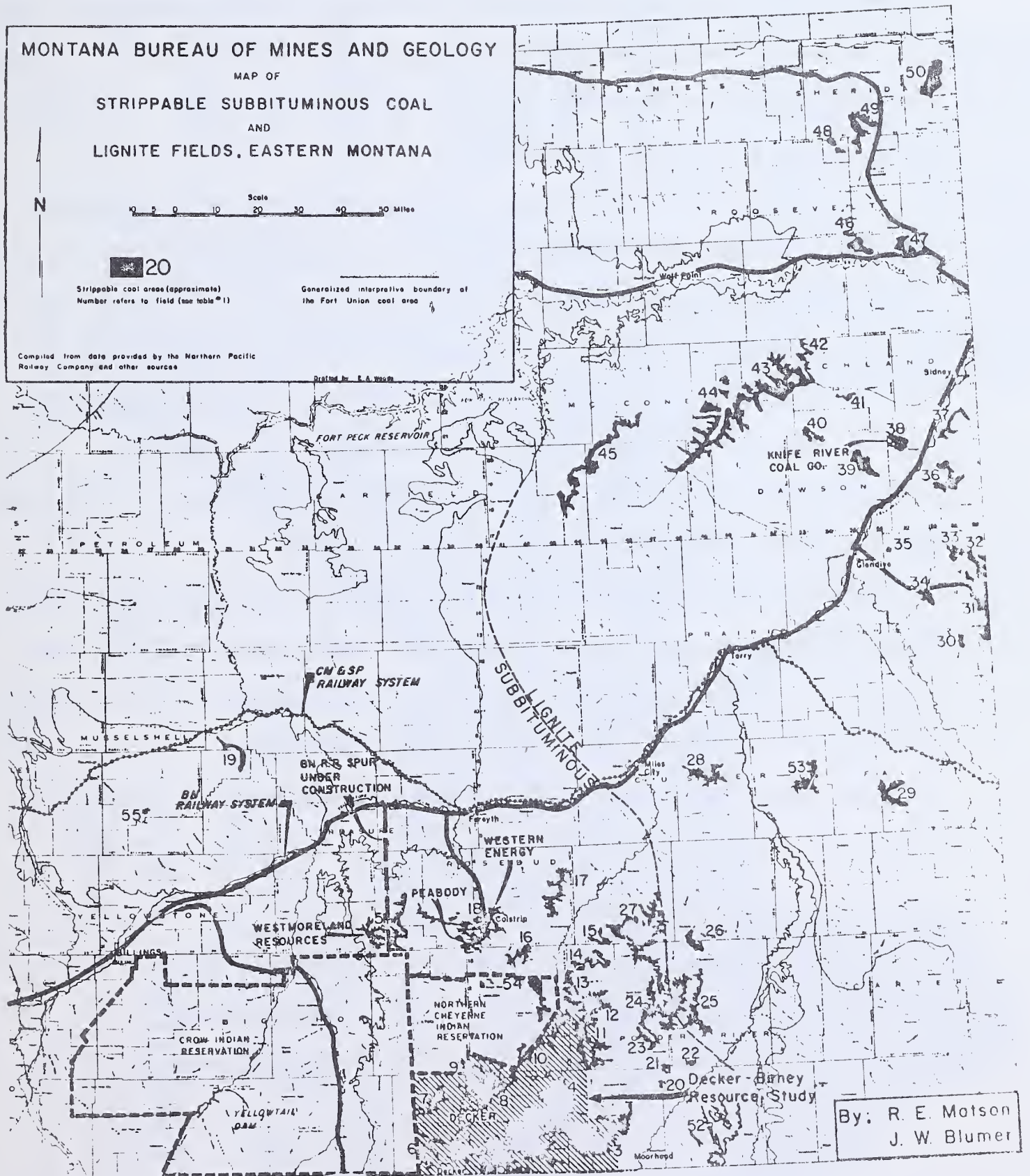
4.3 Geology and Soils*

The Decker-Birney study area is part of the Missouri Plateau, an unglaciated region of the Northern Great Plains in the Midland physiographic area of Montana (Surface Mined Land Reclamation Research in Montana, Montana Agric. Ex. Station). Large portions of the area are underlain by the Fort Union Formation, estimated to contain 40% of the United States coal reserves, which stretches over parts of Wyoming, Montana, North and South Dakota, and Saskatchewan, Canada (see Figure 6). The coal beds in the study area lie within the Tongue River member of the Fort Union Formation. This formation is Paleocene in age and consists of interbedded layers of sandstones, silts, clays and numerous deposits of coal. The coal-bearing portion of the formation was created by fluvial

*This discussion represents a compilation of information contained in the Decker-Birney Resource Study; Coal Development in Eastern Montana; the Montana Coal Task Force Report; Surface Mined Land Reclamation in Montana published by the Montana Agricultural Experiment Station and Montana State University; and the Soil and Water Conservation Plan prepared for Decker Coal Company in cooperation with the Big Horn Conservation District and the Soil Conservation Service.

FIGURE 6

REGIONAL COAL FIELDS LOCATION MAP



*Source: Coal Age, Vol. 78 No. 5, (April, 1973).

deposition of sedimentation from the Rocky Mountains to the west on a low flood-plain containing large subsiding swampy areas. The composition of geologic materials within southeastern Montana is primarily Cenezoic sedimentary rocks with some colluvium deposited during the Quaternary period (Agric. Ex. Station). Throughout the region extensive layers of coal near the surface have burned, baking the overlying rock into a material known as clinker or scoria.

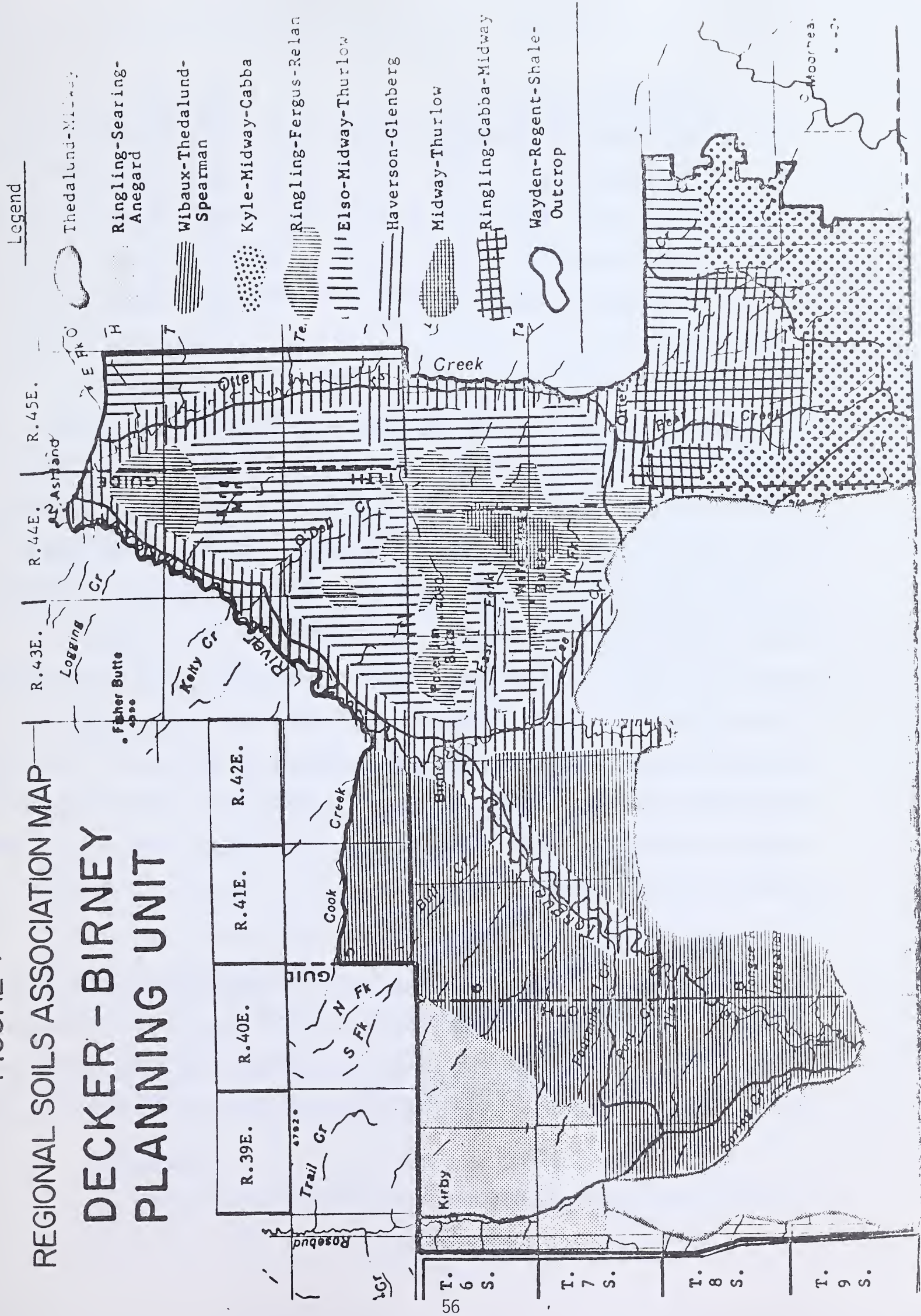
According to the Montana Bureau of Mines and Geology, it is estimated that the Fort Union Formation contains over one trillion tons of coal, but only 31 billion tons or approximately 3% is strippable deposits. It is estimated that 12 billion tons of strippable coal lie within the planning unit. This coal is classified as lignite A (6,300 BTU) to subbituminous B (10,500 BTU). Seams average 25 feet in thickness but exceed 80 feet in some places. Strippable coal is defined as a seam having a minimum thickness of 6 feet and overlain by 150 feet of overburden or less.

There are several known faults in the region including one which passes through the mining site in a southwest to northeast direction, two or three crossing the Tongue Reservoir and another in the northern part of the region. According to the Decker-Birney Resource Study, the planning unit contains ten major soil associations with varying characteristics as listed below (see Figure 7).

<u>Soil Association</u>	<u>Area</u>
Thedalund-Midway	271,490 acres
Wibaux-Thedalund-Spearman	195,000 acres
Ringling-Searing-Anegard	54,780 acres

FIGURE 7

REGIONAL SOILS ASSOCIATION MAP DECKER - BIRNEY PLANNING UNIT



<u>Soil Association (con't)</u>	<u>Area (con't)</u>
Wayden-Regent-Shale Outcrop	5,170 acres
Kyle-Midway-Cabba	54,440 acres
Ringling-Cabba-Midway	25,490 acres
Haverson-Glenberg	54,230 acres
Elso-Midway-Thurlow	158,100 acres
Midway-Thurlow	25,590 acres
Ringling-Fergus-Relan	52,620 acres

The three dominant soil types are Thedalund-Midway, Wibaux-Thedalund-Spearman and Elso-Midway-Thurlow. Thedalund-Midway soils, which are loam and silty clay loam in content, are found in the southern and southwestern portion of the study area including the Decker mining site. These soils have slow to moderate permeability. The Wibaux-Thedalund-Spearman Association in the central western section of the planning unit contains soils composed of loam and channery and cobbly loam with shale outcrops. Permeability varies from moderate to moderately rapid. The Elso-Midway-Thurlow Association in the northeast and east primarily consists of silty clay loam soils exhibiting slow to moderate permeability. The terrain varies from level to rolling (0 - 16% slope) in the northeast and east and undulating to hilly (3% - 30% slope) in the west and the southeast portions of the planning unit.

4.4 Climate

The Decker-Birney study area is typical of the continental climate of the Northern Great Plains which is cold in winter, warm in summer, with large variation in seasonal precipitation. The region is generally classified as semi-arid with annual precipitation at Ashland ranging from 9 to 24 inches, with an average

rainfall of 16 inches. More than half the precipitation occurs during the growing season from April to September, with maximum precipitation peaks in spring and early autumn. Approximately 30% of the precipitation occurs as snow. The growing season is 120 to 130 days in length at Ashland, 10 days shorter at Birney and ranges from 100 to 110 days in the surrounding high country.

Prevailing winds are from the northwest. In summer, thunderstorms with hail and high winds and hot dry windy periods are common, and ground blizzards caused by high winds occur in winter. The average annual temperature for southeastern Montana is 40° to 45°F, with temperatures recorded at Birney ranging from a minimum of -45°F to a maximum of 107°. The annual temperature curve for Sheridan, Wyoming, 20 miles south of the study area, shown in Figure 8, can be considered representative of the Decker-Birney region.

4.5 Water Resources

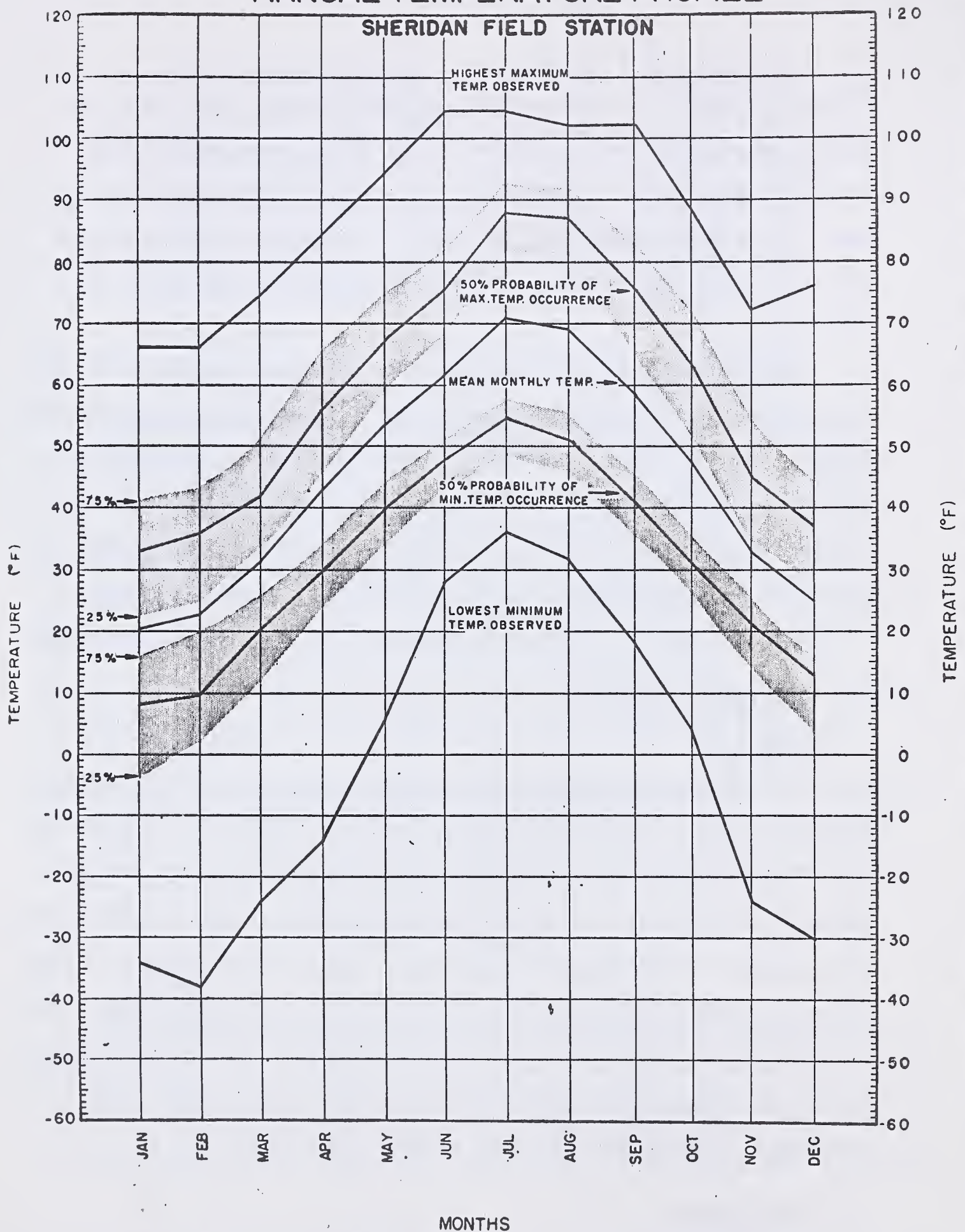
Hydrology

The area surrounding the mining operation lies within the Missouri Hydrologic Region of the Northern Great Plains and the Yellowstone River Sub-Basin. Approximately 90% of the Decker-Birney Study area lies within the Tongue River watershed; all drainage within the area ultimately flows into the Missouri River. The Tongue River Reservoir is located approximately 10 miles north of the Montana-Wyoming state line, northeast of the town of Decker and the mining site. According to the State Water Resources Survey for Big Horn County, the reservoir has a capacity of 73,900 acre-feet of water (used primarily for irrigation) and covers an area of 2,400 acres.

Surface Water

The Decker-Birney Study Area basically encompasses the drainages of the Tongue River, Otter Creek and Rosebud Creek. The Tongue River is the

ANNUAL TEMPERATURE PROFILE



Source: University of Wyoming Agricultural Station, Bulletin 415, 1964.

major stream transversing the region. The drainage area of the river covers 1,477 square miles at the Wyoming-Montana state line and 1,770 square miles upstream from the dam. Numerous intermittent streams also cross the region during certain times of year as a result of rainfall or snowmelt. There is negligible discharge to streams from groundwater sources.

On the basis of long-term streamflow records available for the Tongue River at four sites, it is estimated that approximately 358,000 acre-feet flows into the study area per year at the state line near Decker (USGS Water Resource Data for Montana). The reservoir occupies a surface area of 3,497 acres and has an existing capacity of 68,309 acre-feet (pers. comm. Rick Bondy, Project Engineer, State Water Resources Board). Annual evaporation loss from Tongue Reservoir is 10,000 acre-feet. Surface water quality in the area is generally fair to good, and Tongue River water meets the standards for most domestic and agricultural uses.

Groundwater

Availability of groundwater varies throughout the region dependent on geologic conditions. Alluvial material, which serves as an aquifer, is a major source of supply, with some water also present in sand lenses lying above and below coal seams. Precipitation is the only source of groundwater recharge. Water is also obtained from the numerous seeps, springs and wells throughout the region, with well depths varying from 50 to 200 feet. Groundwater supplies are used primarily for watering livestock and domestic consumption.

4.6 Surface Ownership

The majority of the estimated 900,000 acres contained within the Decker-Birney Study Area (see Figure 4) is public land, with approximately

79,000 acres administered by the Bureau of Land Management, 153,000 acres by the U. S. Forest Service (primarily Custer National Forest), and 48,000 acres by the State of Montana. The remaining 620,000 acres is in private ownership, including most of the land in the immediate vicinity of the mining operation (see Section 3).

4.7 Mineral Ownership

Mineral rights within the region are primarily held by lease from Federal and State agencies, although a small percentage of properties include mineral rights held in fee ownership.

Several major mining concerns hold leases within the study area, including Peabody Coal Company, Western Energy Company, Westmoreland Resources, Consolidation Coal Company, Ayrshire Collieries, Pacific Power & Light Company and others, in addition to Decker Coal Company. Humble Oil & Refinery Company has leases on both private and State lands to the south in Wyoming where MAPCO Corporation also has leased numerous parcels of State land. Only three coal mining operations are currently in production in the region in addition to the Decker Coal Company site: the Big Horn Coal Company operation at Acme, Wyoming, the Rosebud Mine owned by Western Energy Company and Big Sky Mine operated by Peabody Coal Company at Colstrip, Montana.

While 90% of the land within the Decker-Birney Study Area is covered by oil and gas leases and prospecting permits issued to major companies such as Gulf Mineral Resources, Shell Oil Company, Humble Oil & Refining Company and others, no discoveries have yet been reported.

4.8 Present and Projected Land Use

Present Land Use

The predominant land use in the region is grazing. Agricultural production is limited to 31,000 acres of the total 900,000 acres due to the lack of arable land. Major dryland crops are hay and grain while the leading irrigated crop is alfalfa, all grown for local consumption. Recreation is a major activity, primarily fishing, hunting and boating along the Tongue River and Reservoir and other waterways. Commercial timber is harvested from Custer National Forest by contract and also on private lands. Approximately 13,000 acres are currently in production in the study area* (pers. comm. Jim Binando, Bureau of Land Management), primarily within the National Forest, producing an annual average yield of 1.5 million board feet out of a maximum allowable annual cut of 4.5 million board feet (pers. comm. Ernest Kehrberg, U.S. Forest Service). Commercial harvesting of timber on private land has become significant only recently in response to the increase in demand, with approximately 7 to 8 million board feet harvested in the planning unit and surrounding areas within the last year (pers. comm. Larry R. Pike, State Department of National Resources and Conservation).

Large deposits of low-sulfur coal constitute a valuable resource in the area. According to the Montana Bureau of Mines and Geology, there are 227,880 acres (12 billion tons) of strippable coal within the study area. Existing mineral leases and prospecting permits were described in the preceding section. Urban areas including Ashland, Birney, Decker, Quietus and Kirby are small and widely scattered. (See Section 4.1.8.)

*Excluding isolated tracts of timber on the Crow Indian Reservation.

Projected Land Use

To a large degree future land use patterns within the region will depend on the extent to which existing coal resources are developed. Any large scale mining development would directly affect the degree of urban and suburban expansion, commercial and industrial growth and the addition of related transportation and utility facilities. The only new mining operation projected at this time is the Sarpy Creek Mine south of Hysham, Montana, a joint venture owned by Westmoreland Resources and other companies, which is scheduled to start production in 1974. Since large portions of the area are also under lease to numerous other mining companies (see Section 4.1.5), further expansion of mining activity can be expected to occur.

The extent of industrial, commercial and urban expansion will depend largely on the size of any proposed mining development. The amount of new urban development will be determined primarily by the potential for provision of residential facilities in the immediate vicinity of mining operations. Conceivably, larger outlying areas such as Sheridan, Wyoming, or Hardin, Montana, would be more directly affected than existing settlements within the regional area. Increased development could accelerate the traditional pattern of concentration of residential development outside of urban/suburban areas along water-based recreation areas and transportation corridors. Creation of major state or federal highways crossing the region in response to mining-induced expansion could lead to a corresponding development of commercial uses, which are negligible at the present time. In addition, care should be exercised by the responsible management agencies when planning possible development of areas underlain by strippable coal deposits in order to minimize social and economic conflicts.

Most strippable coal reserves underlie existing grazing land.

Within the study area, agricultural expansion is not considered feasible since remaining tracts of arable land may be too small and scattered for efficient production. There is some possibility some public lands could be transferred to the State of Montana under their lieu selection rights or to Big Horn County for recreational use. Commercial production of timber is expected to increase with the projected continued rising price of lumber.

4.9 Growth Projections

Although the Decker Coal Mine is in Southern Montana, nearly 100% of the employees reside in Sheridan County, Wyoming. Montana, under these unusual circumstances, receives nearly all the direct taxes and royalties generated by the mining operation except for a 3% sales tax collected in Wyoming. Growth and economic impacts occurring primarily from additional income and employment affect the State of Wyoming and particularly the City of Sheridan. Economic and growth projections for Montana do not reflect coal mining activities in the Decker area although projections for Sheridan County do incorporate the impacts of an expanded mining operation at Decker through the year 1990.

Perhaps the most comprehensive projection of economic growth in Montana has been the Montana Economic Study. It was completed in 1970 by the Bureau of Business and Economic Research at the University of Montana. Population was projected to increase 8% from 1968 to 1980 in nine South Central counties to a total of 125,300 people. Inducing this growth would be a 15.0% expansion of employment. A continuation of the present trends in several Western states is foreseen, with growth in manufacturing and mining activities balancing

employment lost by the agricultural industry. Significant net economic growth will occur in the services sector, which includes people working in real estate, insurance and local government.

A similar pattern is projected for southeastern Montana. Population and employment will expand 3.9% and 7.7%, respectively, during the same 12-year period. There will be 700 fewer people working in agriculture in 1980 and 500 additional persons employed in manufacturing and mining.

Economic projections for northeastern Wyoming have been published by the Wyoming Department of Economic Planning and Development in Cheyenne. The North Central Power Study, completed in 1972, indicated that the population of the City of Sheridan would grow from 10,856 in 1970 to 14,252 in 1980 and 18,645 people in 1990. Minor coal development in southern Montana was incorporated into the study framework. Each potential coal development project in Wyoming was considered in terms of its size and the estimated date of construction, and growth was distributed among the existing population centers according to their size and distance from the potential project. The results indicated that Sheridan and Buffalo would absorb about 59% and 38%, respectively, of any development between Buffalo and Sheridan. The town of Buffalo, located 36 miles south of Sheridan, was projected to grow from its existing population of slightly more than 3,000 people to 7,639 in 1980 and 14,458 in 1990.

These projections did not fully anticipate the considerable coal development that is now considered to be imminent, and they have now been

revised upward and are included in a study released September 1, 1973, by the Department of Economic Planning and Development. These latest population projections are given below.

	<u>Sheridan Co.</u>	<u>Johnson Co.</u>	<u>Powder River Basin</u>
1975	19,072	5,647	111,52
1980	20,617	7,245	137,053
1985	29,035	23,752	187,550
1990	38,192	18,537	216,461

Whether these projections accurately reflect the population growth that will occur is still subject to speculation. There are a number of factors that are difficult to predict, such as governmental policies, local sentiment and the need for western coal. Federal, State and local governmental policies related to environmental impacts and economic growth in general are still not firmly formulated and implemented. Local opinion regarding the merits of development is mixed and a consensus has yet to surface. The market conditions for coal itself are dependent upon the exploitation of other forms of energy elsewhere in the world which in turn are related to a rather volatile international political scene. This instability is reflected in wildly fluctuating markets for other commodities important in international trade.

5 DESCRIPTION OF THE PROJECT AREA

5. DESCRIPTION OF THE PROJECT AREA

5.1 Land Resources

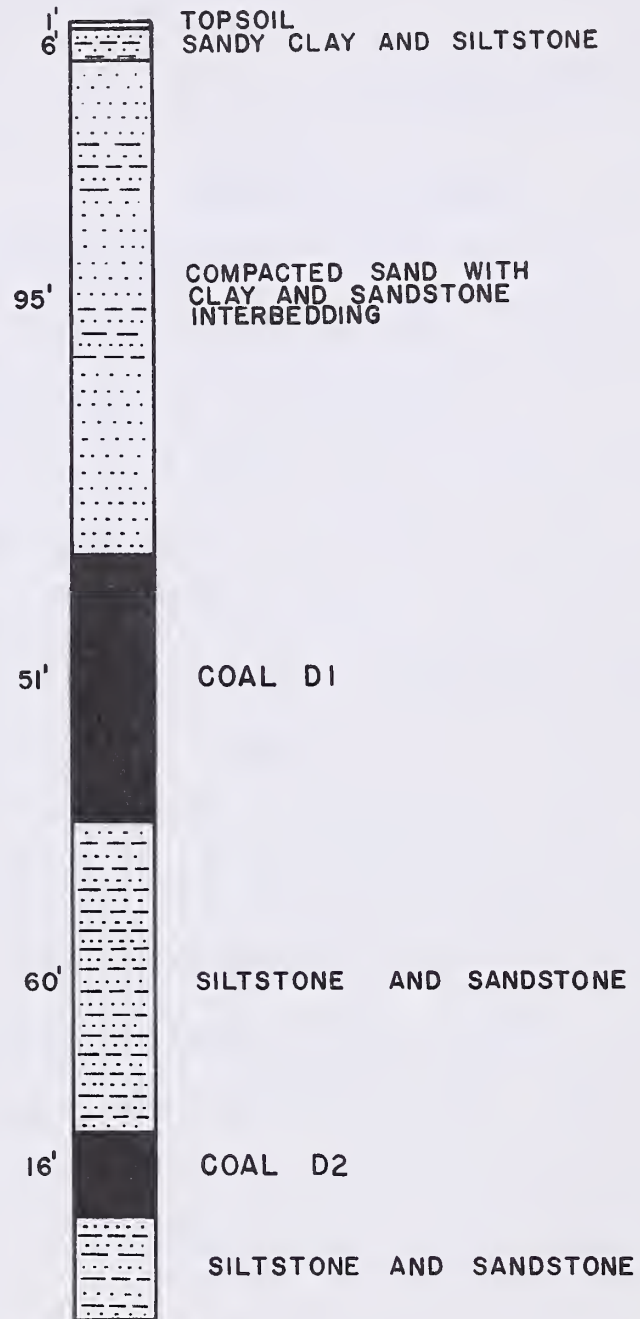
5.1.1 Landform and Geology

The project area is characterized by a flat to gently rolling valley floor surrounded by outcroppings of sandstone. The topography of the mine area is given in the Composite Map. An approximation of the stratigraphy of the intersecting lines, A and B, shown on Figure 2 has been prepared from logs of prospect bore holes. (See Figure 9 for an idealized columnar sketch.) An illustration of the geology of these cross sections has been filed with the State of Montana, Department of State Lands. In general, the topsoil containing organic material is 0 to 2 feet deep. The rolling ridges are composed of sandy alluvial fill with a subsurface of 6 to 8 feet of coarse gravel. Sandy alluvial fill underlies much of the surface of the basin and ranges from 0 to 50 feet in depth. The material between the 52-foot coal seam (D_1) and the sandy alluvial fill is composed almost entirely of three interbedded strata: clay, sandstone and shale. These formations range up to 150 feet thick. The strata between the D_1 coal seam and the D_2 coal seam (approximately 80 feet) is also composed of sandstone, clay and shale formations.

The only known fault in the project area is the South Fault. It runs along the southern perimeter of the mine area where the coal seam southeast of this fault line is vertically displaced downward approximately 100 feet.

The topography and geology of the permit area are also described in the Archaeological Survey contained in the Appendix.

FIGURE 9



IDEALIZED GRAPHIC COLUMNAR SECTION
IN
DECKER COAL FIELD
WITH AVERAGE THICKNESS OF STRATA

SCALE
1"=40'

OCTOBER 1965

JOHN T. BOYD & ASSOCIATES
MINING ENGINEERS

5.1.2 Soils

An extensive soil survey of the mine area was completed by the Soil Conservation Service in August 1972. This survey determined the distribution of 42 soil types in the area and characterized each as to its suitability for use as roadfill, sand and gravel, topsoil and soil features affecting reservoir pond areas, dams, dikes, levees and drainage for crops and pasture. Some physical and chemical properties of these soils were determined, such as permeability, sieve analysis, USDA texture, pH, salinity, etc. The degree and kinds of limitations for construction uses such as sewage lagoons, basements, roads and parking areas, was also included. The native soils were also correlated with shrub and tree species which would produce different qualities of windbreaks depending upon whether or not the plants were irrigated. (See Appendix, Section 17.4.)

The major soil types found in the mine project area include: Clopper-Midway complex, Hydro-Allentown complex, Terry fine sandy loam, Thedaland-McRae loams and For Collins loam. The textures range from silty clay loam with a permeability of 0.06 to 0.2 inch per hour to sandy loams with a permeability rate of 6 to 20 inches per hour. Many of the plants recommended by the soil survey (including caragana and skunkbush sumac shrubs and Russian olive, green ash and ponderosa pine trees) has been test planted in scoria fill or subsurface soil at the Decker Company Mine.

Preliminary chemical analyses of topsoil and overburden samples from the Decker Mine test pit and mine pit were performed by MSU (see Appendix, Section 7.5). Based on these results, they suggest that "some of the overburden at the mine pit is limiting in terms of its ability to support most plant species. The samples were slightly salty and phosphorous and potassium were present in low to

moderate quantities. Sodium, magnesium and calcium content ranged from moderate to high ... even the topsoil of this site is slightly to moderately salty with a considerable amount of sodium present. The topsoil is quite alkaline and has very low to moderate amounts of important macronutrients present." Additional sampling programs are in progress.

RANGE SURVEY REPORTDECKER COAL COMPANYJULY 1973

The following rangeland in T9S, R40E was surveyed by SCS personnel Wayne Nipple and Don Messer on July 5 and 6, 1973:

Section 8	SE $\frac{1}{4}$	Approx.	160 Acres
" 9	E $\frac{1}{2}$ and SW $\frac{1}{4}$	"	450 "
" 10	Portion W of new road	"	320 "
" 15	W $\frac{1}{2}$	"	320 "
" 16	All	"	640 "
" 17	E $\frac{1}{2}$ and NW $\frac{1}{4}$	"	480 "
" 21	N $\frac{1}{2}$ and N $\frac{1}{2}$ SW $\frac{1}{4}$	"	470 "
" 22	NW $\frac{1}{4}$ and N $\frac{1}{2}$ SW $\frac{1}{4}$	"	<u>240 "</u>

Approximate Total 3,080 Acres

Range was found to be generally in fair condition on the flat and rolling areas and in good condition on the steeper slopes.

Refer to the attached range site and condition map for location of the range sites described in this report. A complete inventory of all plant species found on these sites was not made.

Range condition ratings used:

Poor condition - 0-25% of forage production by weight
is from original or climax vegetation.

Fair condition - 25-50%

Good condition - 50-75%

Excellent condition - 75-100%

This area is considered to be a 10-12" annual precipitation zone.

Clayey range site - generally in fair condition. Dominant grasses are western wheatgrass, green needlegrass, and blue grama. Sandberg bluegrass and cheatgrass are also fairly abundant. Some areas support a fairly dense stand of big sagebrush, especially northeast of the Montana Club location. The clayey site in SE $\frac{1}{4}$ section 8 has an estimated 10-20% canopy cover of big sagebrush.

Silty range site - generally in fair condition. Dominant grasses are needle and thread and blue grama. Sandberg bluegrass, prairie junegrass, Japanese brome, cheatgrass, and one-spike oatgrass are common on this site. Big sagebrush, cactus, phlox, astragalus, and salsify are other common plants.

The silty site in the low area east of the headquarters building site in Section 10 is in good condition with needle and thread making up most of the plant community.

The former hay or pasture land in NE¹/₄ Section 9 is a stand of crested wheatgrass. The stand is generally good but plants are low in vigor.

Sandy range site - generally in fair condition. Dominant grasses are needle and thread, western wheatgrass, and blue grama. Other grasses are sandberg bluegrass, prairie junegrass, and Japanese brome. Some areas have big sagebrush in varying amounts up to an estimated 10% canopy cover. Cactus, salsify, slimflower scurfpea, hairy goldaster, and skeletonweed are common on some of the sandy sites.

There are some small areas of sandy site that are in good condition. Needle and thread, prairie sandreed, and some Indian ricegrass are dominants. Brocted spiderwort is a common forb on the better condition sandy sites.

Panspot range site - fair condition. Western wheatgrass, blue grama, and prairie junegrass are the dominant grasses. Green needlegrass, needle and thread, sandberg bluegrass, and Japanese brome are other grasses on this site. Big sagebrush is common on this site; up to an estimated 30% canopy cover in areas. Cactus, salsify and phlox are part of the plant community.

Shallow range site - good condition. Mixture of sandy and silty surface areas with some small rock outcrops. Needle and thread, Indian ricegrass, and threadleaf sedge are dominants. Some areas have bluebunch wheatgrass, sanddropseed, and prairie sandreed. A few skunkbush sumac plants are found around rock outcrop areas. Blue grama and Japanese brome are other grasses found on this site.

Forbs in the plant community are skeletonweed, scarlet globemallow, wavy-leaf thistle, salsify, hood's phlox and bracted spiderwort.

Other shrubs and half shrubs are broom snakeweed, fringed sagewort, and a few scattered big sagebrush and cactus plants.

Thin Hilly range site - generally good condition. Needle and thread, western wheatgrass, and threadleaf sedge are the dominant plants on this site. Other grasses are bluebunch wheatgrass, little bluestem, green needlegrass, prairie sandreed, blue grama, prairie junegrass, sandberg bluegrass, and Japanese brome. Green needlegrass is dominant in the more moist depressions.

The rougher areas of this range site have bluebunch wheatgrass as a dominant plant and have a greater variety of shrubs and forbs.

The thin hilly site in Section 8 has a few scattered ponderosa pine trees; not enough to count per acre.

Yucca, rubber rabbitbrush, skunkbush sumac, greasewood, broom snakeweed, and cactus are shrubs found on parts of this site. Forbs are western yarrow, scarlet globemallow, dandelion, hairy goldaster, crepis, salsify, pussytoes, wavyleaf thistle, silverleaf scurfpea, slimflower scurfpea, blue flox, purple prairieclover, downy paintbrush, hood's phlox, and various astragalus species.

The steep-banked, flat-bottomed drainageways shown in this site have a good stand of prairie sandreed, needle and thread, and yellow sweetclover in many sediment deposit areas.

Shale range site - good to excellent condition. Dominant grasses are bluebunch wheatgrass and needle and thread. Western wheatgrass, green needlegrass, prairie sandreed, blue grama, sandberg bluegrass, side-oats grama, prairie junegrass, red threeawn, and Japanese brome are other grasses found on this site. Threadleaf sedge is common in some areas.

This site has a greater variety of shrub and half shrub species than any other site. Big sagebrush, Nuttall's saltbush, shodscale, skunkbush sumac, winterfat, broom snakeweed, rubber rabbitbrush, common jumper, cactus, silver sagebrush, greasewood, yucca, and fringed sagewort are are found on this site.

Some of the forbs are white and purple prairieclovers, rush skeletonweed, miner's candle, sunflower, hood's phlox, wild onion, dotted gayfeather, slimflower scurfpea, and astragalus species.

List of some of the plants found on the land included in this report:

Grasses:

Bluebunch wheatgrass	Prairie junegrass
Western wheatgrass	Indian ricegrass
Green needlegrass	Japanese brome
Needle and thread	Cheatgrass
Prairie sandreed	Crested wheatgrass
Little bluestem	One-spike oatgrass
Sand dropseed	Red threeawn
Blue grama	Threadleaf sedge
Sandberg bluegrass	Side-oats grama

Sedges:

Threadleaf sedge

Forbs:

Yellowblossom sweetclover	Pussytoes
White prairieclover	Blue flox
Purple prairieclover	Scarlet globemallow
Silverleaf scurfpea	Curlycup gumweed
Slimflower scurfpea	Western yarrow
Breadroot scurfpea	Hawksbeard
Astragalus species	Hairy goldaster
Rush Skeletonweed	Dandelion
Annual sunflower	Wavyleaf thistle
Dotted gayfeather	Bracted spiderwort
Hood's phlox	Stemless nailwort
Wild onion	Miner's candle
Salsify	Scarlet gaura
Downy paintbrush	
Many species of the Cruciferae (mustard) family	

Shrubs, half shrubs and trees:

Big sagebrush	Skunkbush sumac
Silver sagebrush	Common jumper
Rubber rabbitbrush	Ground juniper
Nuttall's saltbush	Ponderosa pine
Shodscale	Yucca
Greasewood	Fringed sagewort
Winterfat	Broom snakeweed
Cottonwood - a few around reservoir sites	

There are no sites that are considered woodland. Juniper and ponderosa pine were found on the more sloping and steep sites, but only in scattered amounts. A count of trees per acre was not considered to be useful.

This report has been prepared by Don Messer, range conservationist with the Soil Conservation Service.

Donald W. Messer

LEGEND FOR RANGE SITES

Range sites are kinds of rangeland that differ from each other in their ability to produce a significantly different kind or amount of climax or original vegetation. Only natural grasslands are classified as range sites. In order to fully designate a range site, a soil-group name is combined with the precipitation zone and geographic location; e.g., sandy 10-14" p.z.; Glaciated Plains, Montana.

The following range soil-groups are listed in presumed order of natural productivity, considering total air-dry weight of all herbage produced through the entire year by all seed plants per unit of area, in ordinary years under climax plant cover.

Names of range sites occurring on your ranch are underlined.

Precipitation Zone

10-14"

Range Site Descriptions:

- I. Soil-groups that can produce more herbage than ordinary range uplands because of plainly superior soil moisture availability.
 - WL - WET LAND: Lands where seepage, ponding, etc., raises the water table to above the surface during only a part of the growing season. Too wet for cultivated crops but too dry for common reed, cattails, or true aquatics.
 - Sb - SUBIRRIGATED: Lands with an effective subsurface ground water table and water rarely over the surface during the growing season.
 - SL - SALINE LOWLAND: Subirrigated and overflow lands where salt and/or alkali accumulations are apparent and salt tolerant plants occur over a major part of the area.
 - Ov - OVERFLOW: Areas regularly receiving more than normal soil moisture because of run-in or stream overflow.
- II. Soil-groups with no obvious soil or moisture limiting factors. The vegetation can make a normal response to climate.
 - Sa - SANDS: Sands and loamy sands more than 20 inches deep.
 - Sy - SANDY: Coarse to fine sandy loams more than 20 inches deep.
 - Si - SILTY: Soils more than 20 inches deep, of very fine sandy loam, loam, or silt loam. This includes soils with 2 inches or more of silt loam over clayey subsoils.
 - Cy - CLAYEY: Granular clay loam, silty clay loam, silty clay, sandy clay or clay more than 20 inches deep.
- III. Soil-groups with characteristics or topographic features that limit moisture holding capacity or affect infiltration rates.
 - TH - THIN HILLY: Loamy or clayey soils on steep or hilly landscapes with a thin A horizon and weak or no structure in the subsoil, but with significant root penetration deeper than 20 inches. It is usually calcareous but contains less than 15 percent calcium carbonate.
 - St - STONY: Soils more than 20 inches deep with cobbles or stones occupying 40 - 80 percent of the surface.
 - Ly - LIMY: Soils more than 20 inches deep that are nearly white and very limy (15 percent or more calcium carbonate) within four inches of the surface.
 - SwC - SHALLOW CLAY: Shallow granular clay soils that are 10 to 20 inches deep to underlying shale or nearly impervious clays.
 - SwG - SHALLOW TO GRAVEL: Soils that are 10 to 20 inches deep to sandy gravel. Few roots penetrate deeper than 20 inches.
 - Sw - SHALLOW: Soils 10 to 20 inches deep to hard rock or softbeds of decomposed granite, siltstone, or sandstone. Few roots penetrate deeper than 20 inches.
 - Ps - PANSPOTS: Areas of silty, clayey or sandy soils in complex with shallow depressions of hard clays or other nearly impervious materials at or near the surface. The shallow depressions occupy 20 to 50 percent of the site.
 - DC - DENSE CLAY: Relatively impervious deep nongranular clays -- may be overlain by thin ineffectual layers of other materials. The dispersed layer is very hard to extremely hard when dry and very sticky when wet.
 - TB - THIN BREAKS: Mixed soils of various depths with hard rock or other resistant bed outcroppings at different levels on steep irregular slopes. Trees may occur locally above outcrops.
 - Gr - GRAVEL: Coarse textured soils with more than 50 percent gravel and cobbles underlain by loose sand and gravel at less than 20 inches.
 - VS - VERY SHALLOW: Areas where few roots can penetrate deeper than 10 inches. Outcropping of gravel or bedrock is characteristic. Joints in bedrock may develop deep soil pockets usually marked by tall grasses, shrubs, or stunted trees.
 - SU - SALINE UPLAND: Soils more than 20 inches deep with salt and/or alkali accumulations. Salt tolerant plants occur over a major part of the area.
 - Sh - SHALE: Readily puddled uplands where some unweathered angular raw shale fragments are exposed at the surface and little, if any, soil profile development is evident.
 - Bl - BADLANDS: Nearly barren lands broken by drainages intermingled with small grazable areas.

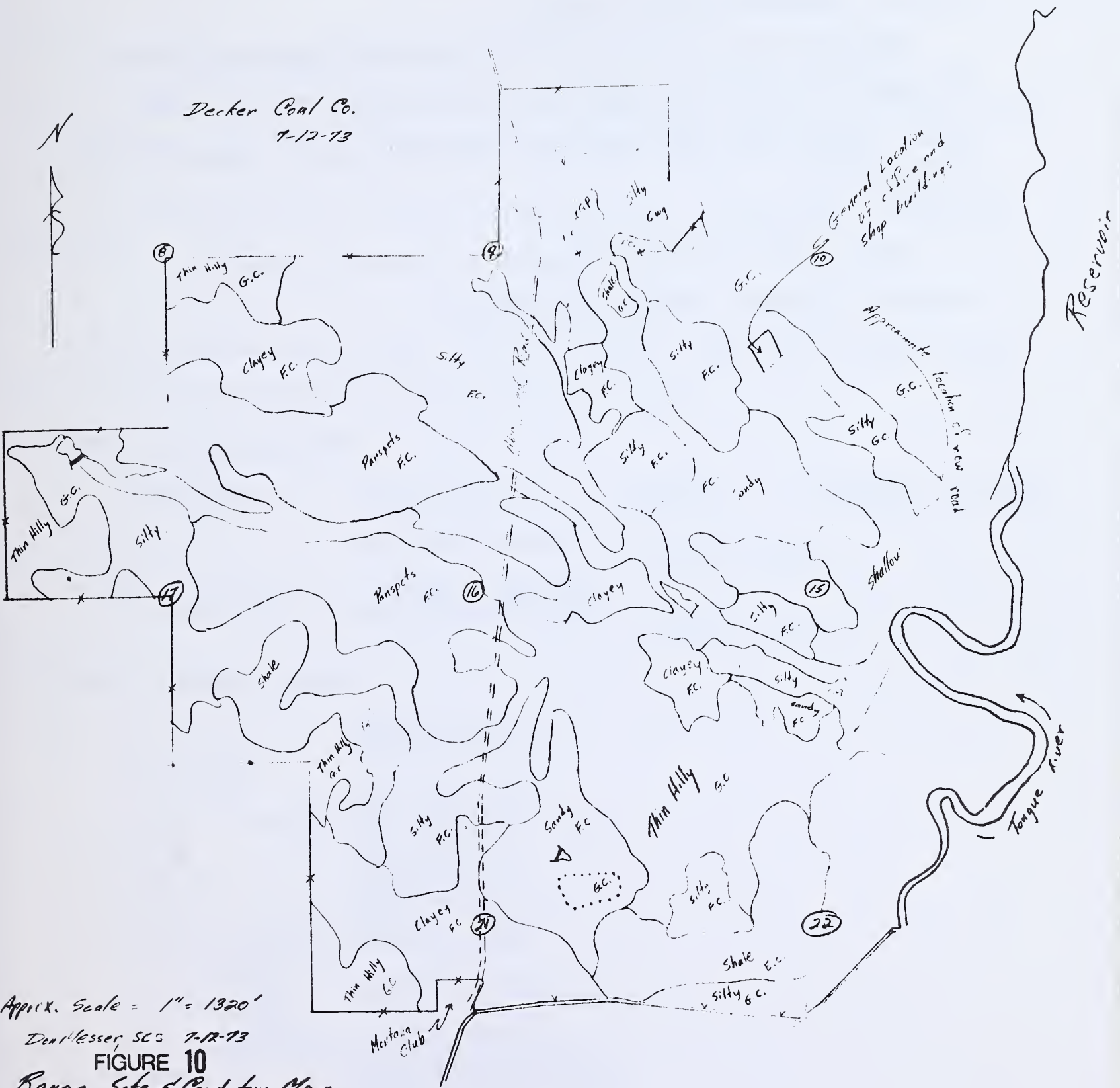
LEGEND FOR CONSERVATION PLAN MAP

	Farm or Ranch Boundary		Field or Pasture Number		Natural Barrier
	Field or Land Use Boundary		Field or Pasture Acreage		Corral
	Capability Unit, Range Site or Forest Site Boundary		Public Road		Land Use Tie
	Range Condition or Forest Inventory Boundary		Farm Road		Building
			Trell		Farmstead
			Railroad		Wildlife Area
RANGE CONDITION CLASSES:			Perennial Stream		
E C -	Excellent (75-100% original kind of veg.)		Intermittent Stream		
G C -	Good (50-75% original kind of vegetation)		Spring		
F C -	Fair (25-50% original kind of vegetation)				
P C -	Poor (0-25% original kind of vegetation)				

Existing	Planned		Existing	Planned	
		Fence along Farm or Field Boundary			Irrigation ditch or canal
		Fence along Public Road			Flume or syphon
		Electric Fence			Open drain ditch
		Shelterbelt or windbreak			Closed drain
		Dam and Reservoir (Arrow indicates spillway location)			Division Box or turnout
		Spring Development			Pipe Riser
		Spring and tank			Check
		Water Tank			Drop
		Well			Diversion or spreader dam
		Well and Windmill			Weir, Pershell flume or other measuring device
		Well, Windmill and Tank			Power line
		Pump			Direction of Irrigation
		Vegetated Outlets and Waterways			Spreader dike or ditch
		Pipeline or Sprinkler Main			Stream bank protection

*Add to legend any additional symbols used on map.

Decker Coal Co.
7-12-73



Approx. Scale = 1" = 1320'
Dent/Kesser, SCS 7-12-73

FIGURE 10
Range Site & Condition Map
Decker Coal Company, 1973

5.1.3.2 Preliminary Wildlife Survey

During the past year the following wildlife were observed by employees of Decker Coal Company while working in the coal mine area: Fox, Bobcat, Rabbit, Gopher, Skunk, Bat, Bullsnake, Golden Eagle, Turtle, Frog, Rattlesnake, and Mule deer.

The following preliminary survey was only recently completed; additional biological surveys are in progress.

A preliminary survey of wildlife within the proposed mining limits was conducted from August 22-24, 1973 by Ken Proctor, Research Assistant at MSU.

METHODS

Observations were made while traversing the area by foot and automobile. The following items were used to conduct the survey: clipboard and paper, binoculars (7x35), wildlife field guides, spotlight, and snap traps and rat traps. Two morning and two evening observation periods of four hours each were made. Trapping was conducted for two nights.

RESULTS:

The following is a list of species observed, species expected to be found on the area, and species which possibly may be found on the area:

A. MAMMALS - BIG GAME SPECIES

<u>Common Name</u>	<u>Scientific Name</u>	<u>Observed</u>	<u>Expected</u>	<u>Possibly</u>
1. Mule deer	<u>Odocoileus heminous</u>	*(4 total 2 does; 2 fawns)		
2. White-tail deer	<u>Odocoileus virginianus</u>		*	
3. Pronghorn antelope	<u>Antilocapra americana</u>	*(7 total 3 does; 4 kids)		

B. MAMMALS - NON-GAME SPECIES

1. Red fox	<u>Vulpes vulpes</u>	*		
2. Striped skunk	<u>Mephitis mephitis</u>	*		
3. White-tailed jack rabbit	<u>Lepus townsendii</u>	*		
4. Eastern cottontail	<u>Sylvilagus floridanus</u>		*	
5. Coyote	<u>Canis latrans</u>		*	
6. Badger	<u>Taxidea taxus</u>		*	
7. Porcupine	<u>Erethizon dorsatum</u>			*
8. Raccoon	<u>Procyon lotor</u>			*
9. Long-tailed weasel	<u>Mustela frenata</u>			*
10. Yellow-bellied marmot	<u>Marmota flaviventris</u>		*	
11. Northern pocket gopher	<u>Thomomys talpoides</u>		*	
12. Western deer mouse	<u>Peromyscus maniculatus</u>	*		
13. Meadow vole	<u>Microtus pennsylvanicus</u>			*
14. Bobcat	<u>Lynx rufus</u>		*	
15. Thirteen-lined ground squirrel	<u>Citellus tridecemlineatus</u>	*		
16. Least chipmunk	<u>Eutamias minimus</u>			*
17. Little brown bat	<u>Myotis lucifugus</u>		*	
18. Richardson ground squirrel	<u>Citellus richardsonii</u>			*

B. MAMMALS CONT'D.

	<u>Common Name</u>	<u>Scientific Name</u>	<u>Observed</u>	<u>Expected</u>	<u>Possibly</u>
19.	Northern grasshopper mouse	<u>Onychomys leucogaster</u>			*
20.	Western harvest mouse	<u>Reithrodontomys megalotis</u>			*
21.	Meadow jumping mouse	<u>Zapus hudsonius</u>			*
22.	Sagebrush vole	<u>Lagurus curtatus</u>			*
23.	Wyoming pocket mouse	<u>Perognathus fasciatus</u>			*
24.	Prairie vole	<u>Microtus ochrogaster</u>			*

C. UPLAND - Upland Game Species

	<u>Common Name</u>	<u>Scientific Name</u>	<u>Observed</u>	<u>Expected</u>	<u>Possible</u>
1.	Sharptail grouse	<u>Pedioecetes phasianellus</u>			*
2.	Sage grouse	<u>Centrocercus urophasianus</u>		*	
3.	Ring-necked pheasant	<u>Phasianus colchicus</u>		*	
4.	Hungarian partridge	<u>Perdix perdix</u>			*

D. PREDATORY BIRDS

1.	Turkey vulture	<u>Coragyps atratus</u>	*		
2.	Golden eagle	<u>Aquila chrysaetos</u>		*	
3.	Sparrow hawk	<u>Falco sparverius</u>	*		
4.	Marsh hawk	<u>Circus cyaneus</u>	*		
5.	Swainson's hawk	<u>Buteo swainsoni</u>		*	
6.	Red-tailed hawk	<u>Buteo jamaicensis</u>	*		
7.	Cooper's hawk	<u>Accipiter cooperii</u>		*	
8.	Great horned owl	<u>Bubo virginianus</u>		*	
9.	Short-eared owl	<u>Asio flammeus</u>		*	
10.	Ferruginous hawk	<u>Buteoregalis</u>			*
11.	Pigeon hawk	<u>Falco columbarius</u>			*
12.	Prairie falcon	<u>Falco mexicanus</u>			*
13.	Rough-legged hawk	<u>Buteo lagopus</u>			*
14.	Harlan's hawk	<u>Buteo harlani</u>			*

E. WATER BIRDS

1.	Blue-wing teal	<u>Anas discors</u>			*
2.	Green-wing teal	<u>Anas carolinensis</u>			*
3.	Mallard	<u>Anas platyshynchos</u>			*
4.	Bufflehead	<u>Bucephala albeola</u>			*
5.	Solitary sandpiper	<u>Tringa solitaria</u>	*		
6.	Spotted sandpiper	<u>Actitis macularia</u>		*	
7.	Killdeer	<u>Charadrius vociferus</u>	*		
8.	American coot	<u>Fulica americana</u>			*

F. SONG BIRDS

1.	Mountain bluebird	<u>Sialia currueoides</u>	*		
2.	Mourning dove	<u>Zenaidura macroura</u>	*		
3.	Western meadowlark	<u>Sturnella neglecta</u>	*		
4.	Black-billed magpie	<u>Pica pica</u>	*		
5.	Robin	<u>Turdus migratorius</u>	*		
6.	Red-shafted flicker	<u>Colaptes cafer</u>	*		
7.	Vesper sparrow	<u>Pooecetes gramineus</u>	*		
8.	Lark sparrow	<u>Chondestes grammacus</u>	*		
9.	Brewer's blackbird	<u>Euphagus cyanocephalus</u>	*		
10.	Red-winged blackbird	<u>Agelaius phoeniceus</u>	*		
11.	Starling	<u>Sturnus vulgaris</u>	*		
12.	Barn swallow	<u>Hirundo rustica</u>	*		
13.	Eastern kingbird	<u>Tyrannus tyrannus</u>	*		
14.	Cliff swallow	<u>Petrochelidon pyrrhonota</u>	*		
15.	Common raven	<u>Corvus corax</u>			*
16.	American goldfinch	<u>Spinus tristis</u>	*		
17.	Upland plover	<u>Bartramia longicauda</u>			*

F. OTHER BIRDS CONT'D.

	<u>Common Name</u>	<u>Scientific Name</u>	<u>Observed</u>	<u>Expected</u>	<u>Possible</u>
18.	Sage thrasher	<u>Oreoscoptes montanus</u>			*
19.	Common nighthawk	<u>Chordeiles minor</u>	*		
20.	Loggerhead Shrike	<u>Lanis ludovicianus</u>		*	
21.	Common crow	<u>Corvus brachyrhynchos</u>		*	
22.	Western kingbird	<u>Tyranus verticalis</u>		*	
23.	Lark bunting	<u>Calamospiza melanocorys</u>	*		
24.	Say's phoebe	<u>Sayornis saya</u>		*	
25.	Horned lark	<u>Eremophila alpestris</u>			*
26.	Pinyon jay	<u>Gymnorhinus cyanocephalus</u>			*
27.	Brown-headed cowbird	<u>Molothrus ater</u>		*	
28.	Brewer's sparrow	<u>Spizella breweri</u>			*
29.	White-crowned sparrow	<u>Zonotrichia leucophrys</u>			*
30.	Song sparrow	<u>Melospiza melodia</u>			*
31.	McCown's longspur	<u>Rhynchophanes mccownii</u>			*

G. In addition, several turtles, frogs and snakes were observed but not identified.

CONCLUSION

This list of wildlife is presented as a preliminary study since the observation period was limited to only two days and two nights. These observed species can only be interpreted as representative of the species which may be expected to occur during this season. A total of seven different species of mammals were observed; however, as many as 27 species may possibly occur in this area. Twenty-three birds were observed, of which 17 were song birds; as many as 57 birds may possibly be expected to occur within the area.

5.1.3.3 Rare and Endangered Species

According to the State of Montana, Department of Fish and Game (personal comm., Mr. Vinciana), the following mammals, birds, fish and reptiles occur in Montana and are included in the list of rare and endangered species, prepared by the U. S. Bureau of Sports Fisheries and Wildlife:

A. Mammals

Rare and endangered:	Blackfooted ferret Spotted bat Grizzly bear
----------------------	---

Status undetermined:	Canadian Lynx Fisher Pine Martin Northern Swift fox Wolverine
----------------------	---

B. Birds

Endangered:	Peregrine falcon Eskimo curlew Whooping crane
-------------	---

Rare:	Prairie falcon Greater Sand Hill Crane Northern Greater prairie chicken
-------	---

Status undetermined:	Ferruginous hawk Osprey Mountain plover Columbian sharp-tailed grouse
----------------------	--

C. Fish

Endangered:	Cutthroat trout
-------------	-----------------

Rare:	Arctic grayling
-------	-----------------

Status undetermined:	White sturgeon
----------------------	----------------

D. Reptiles and Amphibians

Rare or endangered:	Western box turtle
Status undetermined:	Spiny soft shelled turtle Western painted turtle Snapping turtle

While none of these species were identified during the preliminary wildlife survey, the possibility remains that some of these species may be expected to occur within the projected mine limits or bordering the projected mine limits. Based upon the distribution and habitat preference of these species, three birds may possibly be expected to use the permit area: Peregrine falcon, Eskimo curlew and Prairie falcon.

5.1.4 Archaeological and Historic Sites

The following documents are summary reports of independent archaeological and historic surveys of the project area. The archaeological survey was conducted by the University of Montana, Statewide Archaeological Survey and the survey for evaluation of possible historical sites was conducted by Mr. Robert A. Murray for Western Interpretive Services. The complete archaeological report is included in the Appendix (Section 17.3).

ARCHAEOLOGICAL SURVEY SUMMARY

On May 19, 1971 the Decker Coal Company contracted with the University of Montana Founcation for an Archaeological Survey on the following described lands in Big Horn County, Montana:

Township 9 South, Range 40 East, M.P.M.

Section 8:	SE $\frac{1}{4}$ SE $\frac{1}{4}$
Section 9:	S $\frac{1}{2}$, NE $\frac{1}{4}$
Section 10:	Portion S $\frac{1}{2}$ West of Highway
Section 15:	W $\frac{1}{2}$, Portion E $\frac{1}{2}$ West of Highway
Section 16:	All
Section 17:	N $\frac{1}{2}$, SE $\frac{1}{4}$
Section 21:	N $\frac{1}{2}$, N $\frac{1}{2}$ SW $\frac{1}{4}$
Section 22:	NW $\frac{1}{4}$

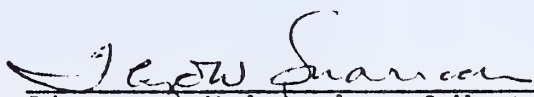
Archaeological field survey upon the above lands was completed by the Statewide Archaeological Survey during July 1971. Several sites were found on or near Decker lease lands. The sites warrant no further attention as they are small surface to slightly subsurface sites. Upon completion of laboratory analysis, a complete report with recommendations will be given to the Decker Company on or before May 19, 1972.

Enclosed is a signed antiquities release as specified on Page 2, Part 2 Sec. H of the agreement, indicating that all requirements of the Federal Antiquities Acts have been met by the Decker Company upon the above described lands.

The University of Montana Statewide Archaeological Survey has inventoried and salvaged where appropriate, archaeological resources on the following lands:

Lands limited in the agreement of May 19, 1971 between Decker Coal and the U. of Montana.

We certify that to this extent, Decker Coal Company has met all obligations for archaeological salvage under the Federal Antiquities Acts.



Director, University of Montana
Statewide Archaeological Survey



Date

HISTORICAL SURVEY SUMMARY

Introduction

This study has been prepared at the request of Decker Coal Company as a part of a project coordinated by VTN.

The area under study consists of the following tracts, outlines on map supplied by Decker Coal Company (U.S.G.S. Decker 7 $\frac{1}{2}$ ' quadrangle, with supplementary detail).

- T. 8 S., Range 40 East:
 - Section 32, N $\frac{1}{2}$ and SE $\frac{1}{4}$
 - Section 33, all
- T. 9 S., Range 40 East.
 - Section 3, W $\frac{1}{2}$
 - Section 4, S $\frac{1}{2}$, NE $\frac{1}{4}$, E $\frac{1}{2}$ of NW $\frac{1}{4}$
 - Section 10, all
 - Section 9, S $\frac{1}{2}$, NE $\frac{1}{4}$, E $\frac{1}{2}$ of NW $\frac{1}{4}$
 - Section 15, W $\frac{1}{2}$
 - Section 16, all
 - Section 8, SE $\frac{1}{4}$ of SE $\frac{1}{4}$
 - Section 17, N $\frac{1}{2}$ and SE $\frac{1}{4}$
 - Section 21, all
 - Section 22, W $\frac{1}{2}$

Total area of the above tracts, as mapped, is some 5,760 acres, more or less.

Principal investigator for this project was Robert A. Murray (resume supplied to Decker Coal Company and to VTN). Western Interpretive Services has extensive research holdings of its own on the Montana/Wyoming region. These were supplemented by research in local library collections, aerial photo interpretation, and by direct examination of the site by the principal investigator.

During these investigations, we made an effort to determine what events that might have significance had occurred here, and whether there were sites or structures related to those events still possessing consequent physical integrity. We also evaluated structures within the study area to determine whether they had particular architectural merit either as individual works or as representative specimens of dis-

tinctive types of regional architecture.

Our criteria for historic significance were drawn from the Historic Preservation Act of 1966 and subsequent regulations and instructions promulgated by the Secretary of the Interior through the Keeper of the National Register and the State Liason Officers for Historic Preservation.

There are no sites or structures within the study area upon either the National Register of Historic Places, or the Montana Historic Sites Inventory.

The study area lies in what has for much of the recorded past been a rather quiet "backwater" of human activity in the region. Geographic opportunities and constraints dictated that the main routes of exploration, trade and development bypassed the region, and until the beginning of actual white settlement of the region, only occasional parties passed this way.

The earliest written record of travel through the study area is that of Charles LeRays, who claims to have visited the region during the summer of 1802 in company of a group of traders and Crow and Hidatsa Indians. From August 12 through August 25, the party camped somewhere within a short distance downstream from present Tongue River Dam. On August 25, they moved through the study area and camped at the mouth of Goose Creek, passing the study area without incident.

Other early journalists on the region such as Francois Antoine Larocque (1805) and Wilson Price Hunt (1811) missed the study area by many miles.

The earliest parties engaged in surveying and mapping in the region were those of Captain William F. Reynolds and Lieutenant Henry Maynadier in 1859-1860. They, too, skirted the area by a wide margin.

Active emigrant and military travel in the region accelerated after 1863, when John Bozeman of the Montana gold mining country publicized a trail that consisted of a lining-up of older trails noted by Reynolds, Maynadier, Larocque and LeRays. Civilian and military travel on the

Bozeman trail brought that route national publicity, and that easy gradient route became the usually chosen southeast/northwest travel route through the area.

The main course of action in the Indian Wars of the region from 1865-1877 completely bypassed this area, and the only military part of note to travel through the region was Brigadier General George Crook's column en route from a base camp on Little Goose Creek to a junction with the forces of General Alfred Terry. Crook's forces (about 1,500 men) camped on the night of August 5th at the mouth of Prairie Dog Creek and marched past the study area on August 6th. They evidently followed the river bottom to the east, since they reported crossing Tongue River 13 times in one day. They did not camp within the study area.

Occasional military parties in the Post-Indian War days of 1878-1894 passed through the region, but they were usually simply messengers between Fort McKinney and Fort Keogh. The army reconnoitred two wagon routes between these posts, one lying to the east of Tongue River, and the other crossing to the Rosebud and descending that stream to its mouth. Neither of these was ever used by a military wagon train, so far as we can determine.

Throughout the early ranching settlement history in the region, the study area remained "in the back country." The Rock Creek Stage Company line passed from Buffalo to Big Horn and to Dayton and to Pass Creek, following the old Bozeman Trail, and then followed the Little Horn River to Fort Custer on the Big Horn, thence across country to Terry's

Landing on the Yellowstone. Later, this route (in 1883) was shifted to "Custer City" on the Northern Pacific railway. With the main transportation line through the region bypassing the area, there was little travel through this region except by ranchers going to and from Sheridan.

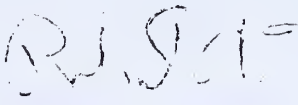
Homesteading expanded in this region coincident with the rise in wheat prices at the time of World War I, and most of the structures within the study area date from that period or later.

In the southern portion of the study area outside the area of any probably surface mining lies a cluster of commercial and residential buildings. Most of these are less than 40 years old, and together they constitute a marginal series of commercial ventures of no particular historic significance and certainly of consequential architectural merit.

Just outside the study area to the east lies a "homestead" settlement, consisting of the ruin of a stone barn, and a small house finished in shingles. These structures have neither historic significance nor significance by association with important personages, nor architectural merit.

In the northern part of the area is the old Tongue River or Decker Coal mine. It is typical of the small mines of the area, and was not a significant producer in the sense that other mines nearer Sheridan were. This tract contains no structures we would deem historic.

In summary, then, we believe that mining operations to date and projected mining operations as mapped have had no impact on any historically significant properties within the study area. Further operations anywhere within the indicated study area will have no impact on historic resources.


Robert A. Murray

ALL MAIL TO
P. O. Box 6467
Sheridan, Wyoming 82801

WESTERN INTERPRETIVE SERVICES

COMPLETE INTERPRETIVE SYSTEMS PLANNING

307 674-4504

OFFICES AT:
Suite 207
48 N. Main
Sheridan, Wyoming 82801

September 21, 1973

Mr. Gary Fletcher
Decker Coal Company
104 S. Main Street
Sheridan, Wyoming 82801

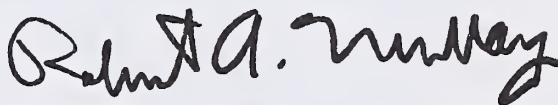
Dear Gary:

As a follow-up to your phone call of this morning, we would like to state that page 5 of our historical report on the West Decker area contains a typographical error when compared to our original draft.

The last sentence of Paragraph 2 should read "Most of these are less than 40 years old, and together they constitute a marginal series of commercial ventures of no particular historic significance and certainly of no consequential architectural merit."

We are certainly sorry that this error has caused some inconvenience to your firm and are pleased that you have called this to our attention.

Cordially,



Robert A. Murray
Interpretive Planning Consultant

RAM:jrg

5.2 Water Resources

5.2.1 Drainage Patterns

The project area is located primarily within the Pond Creek drainage basin which receives 11 to 15 inches of precipitation per year. The Pond Creek is an intermittent stream. A portion of the mining area, primarily diverted surface flow from the upper Pond Creek drains into the Tongue River via Pearson Creek approximately one mile north. This creek is also intermittent; surface water occurs in these creeks only as a result of precipitation. The drainage basin for Pond Creek is between the south fork of Spring Creek and Squirrel Creek. This represents an area of approximately 20 to 30 square miles. The original drainage pattern has been greatly changed due to construction of diversion dams, dikes and ditches and mining operations. The major dam was built across the upper Pond Creek more than 30 years ago to create a stock reservoir. A diversion dike for highwater overflow from this dam has also been constructed. This earthen work will eventually be reclaimed.

A series of four diversion channels and eight diversion dikes have been constructed to divert surface runoff water from the mine area (see Composite Map). The two main diversion channels run from the stock reservoir along the base of the sandstone outcroppings north and south of the mine. Of these, the channel which runs north to Pearson Creek is expected to divert most of the surface runoff from the upper Pond Creek drainage area. During highwater runoff, the second southern channel will also drain from the stock reservoir. These main diversion channels are expected to exist for the lifetime of the mine. Smaller temporary diversion channels and dams drain the area inside the proposed mine

limit. Again, one runs north to Pearson Creek and another south to the settling pond. (See Composite Map.) Surface water which collects behind the largest diversion dam is pumped to the settling pond. Often during the year, the entire drainage system is dry.

5.2.2 Groundwater

In the spring of 1971 the Montana Bureau of Mines and Geology began a program to monitor groundwater quality and quantity as well as to evaluate the effect of mining operations on the groundwater. The following is based upon personal communication with W. Van Voast. At present there are fourteen test wells; more are planned. The location of twelve of these wells are shown in Figure 11. Each location has two wells: one draws only from the D_1 aquifer and the second draws only from the D_2 aquifer. Another set of wells (not shown) is located approximately one mile north of the mine site.

The major underground water courses are in the D_1 and D_2 coal seams. The estimated natural groundwater flow prior to mining operation was 100,000 gallons per day. The recharge area for these is unknown; however, flow in this system is from west to east.

The D_2 aquifer has more pressure than the D_1 aquifer; consequently there is no water flow from the D_1 to the D_2 aquifer at the mine site or east of the site. However, based upon the fact that chemical analyses of both D_1 and D_2 are essentially similar, these aquifers are expected to communicate west of the project area. The D_1 water course is known to enter the burned coal area and enter the Tongue River; however, the fate of water in the D_2 aquifer is unknown. Both the D_1 and D_2 groundwater courses have been affected by the mining operation. At the box cut there is no D_1 groundwater, and within the boundaries of the box

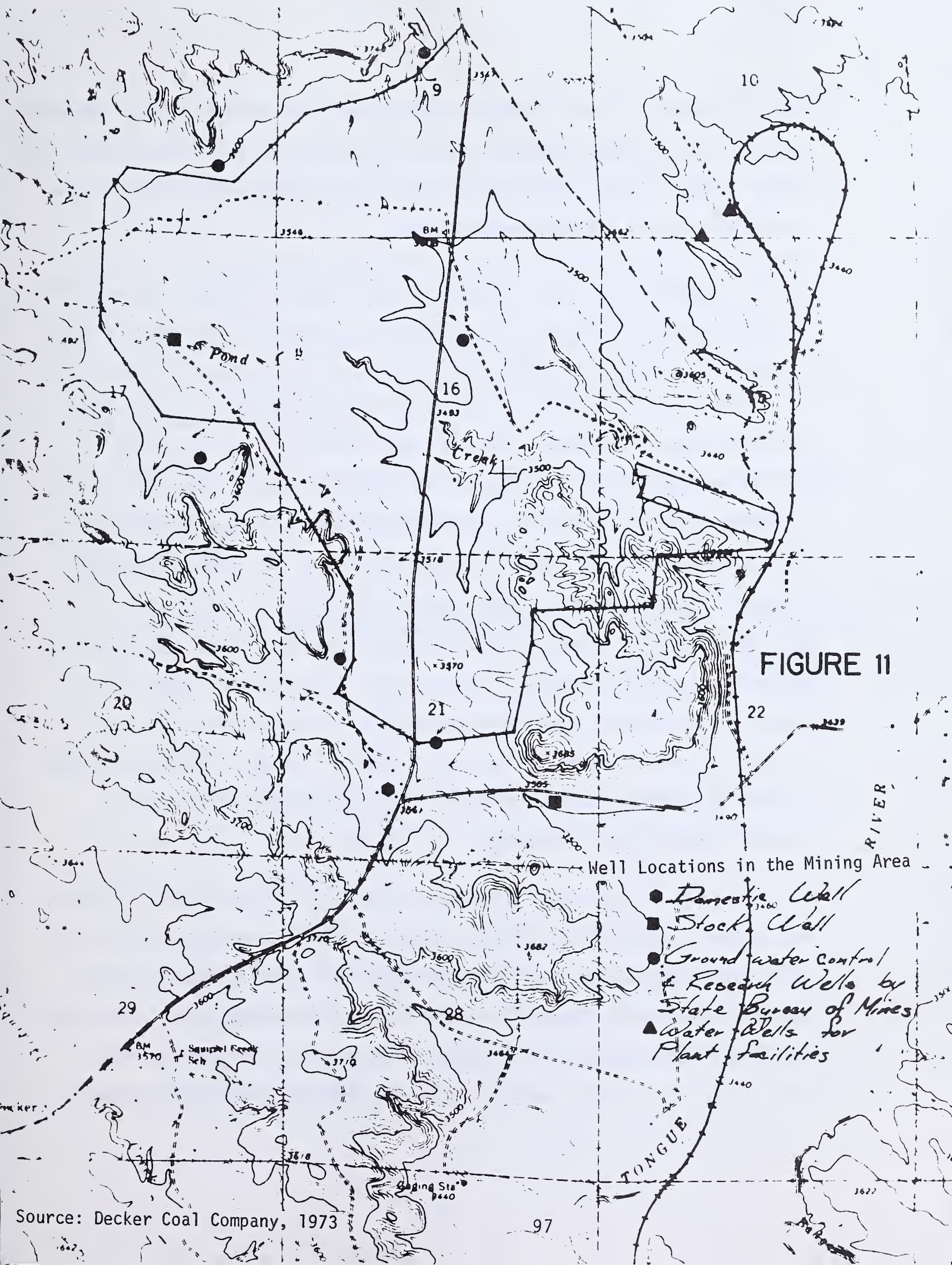


FIGURE 11

Well Locations in the Mining Area

- Domestic Well
- Stock Well
- Ground water control & Research Wells by State Bureau of Mines
- ▲ Water Wells for Plant Facilities

cut, D_1 groundwater levels in two test wells have been greatly reduced, presumably because they have been separated from the D_1 recharge due to mining. However, the test pit which is also located in this area does contain water, probably from both surface runoff and groundwater sources.

The D_1 water percolates from the coal seam where it has been cut and drains toward the scraper pit where it is collected in the sump. (See Composite Map.) At least three other groundwater sources contribute to the total water collected at the sump: aquifer in the sand and overburden at the southern end of the mining operation; groundwater flow from the D_2 aquifer to the D_1 aquifer, possibly the result of both the test wells and the release of pressure due to removal of overburden; and groundwater flow from the Tongue River Reservoir into the mine area. This flow is probably due to the fact that the spillway elevation at the reservoir is 3,424 feet and the top of the coal seam is at elevation 3,420 feet. However, due to seasonal fluctuations of water levels in the reservoir, this difference is not constant. Collectively, these three sources are estimated to contribute only 10% of the total water flow into the sump; the remaining 90% is from the D_1 aquifer. It has also been estimated that the D_1 aquifer flow has increased to 200,000 gallons per day due to pressure release related to mining.

The effect of the mining operation on these aquifers can also be estimated from changes in both the differences in pressure between the D_1 and D_2 aquifers and the absolute change in the level of groundwater in the D_1 aquifer. The following values were estimated by W. Van Voast and are based upon existing data which has not been completely analyzed. It should also be recognized that these values may, in part, reflect seasonal differences in available recharge

water, especially since the monitoring program has only been in existence for two years in the vicinity of the mining operation. Before mining began, the difference in head pressure between the D_1 and D_2 aquifers was approximately 20 feet. After the box cut was made, the difference in pressure increased to approximately 60 feet of head, primarily because of a decrease in pressure in the D_1 aquifer. Near the Montana Club, the difference is approximately 40 feet of head. Test wells west of the mine have a difference in head pressure of only 10 feet; however, this data suggests the interconnections between the D_1 and D_2 aquifers.

The radial influence of the mining operation on the D_1 aquifer groundlevel is a time and direction dependent process. The preliminary data indicate the following:

<u>Aquifer</u>	<u>Change in Groundwater Level</u>	<u>Direction</u>	<u>Distance (ft)</u>
D_1	-10	South	4,800
D_1	- 2	West	5,280
D_2	- 5	South	2,000

5.3 Climate

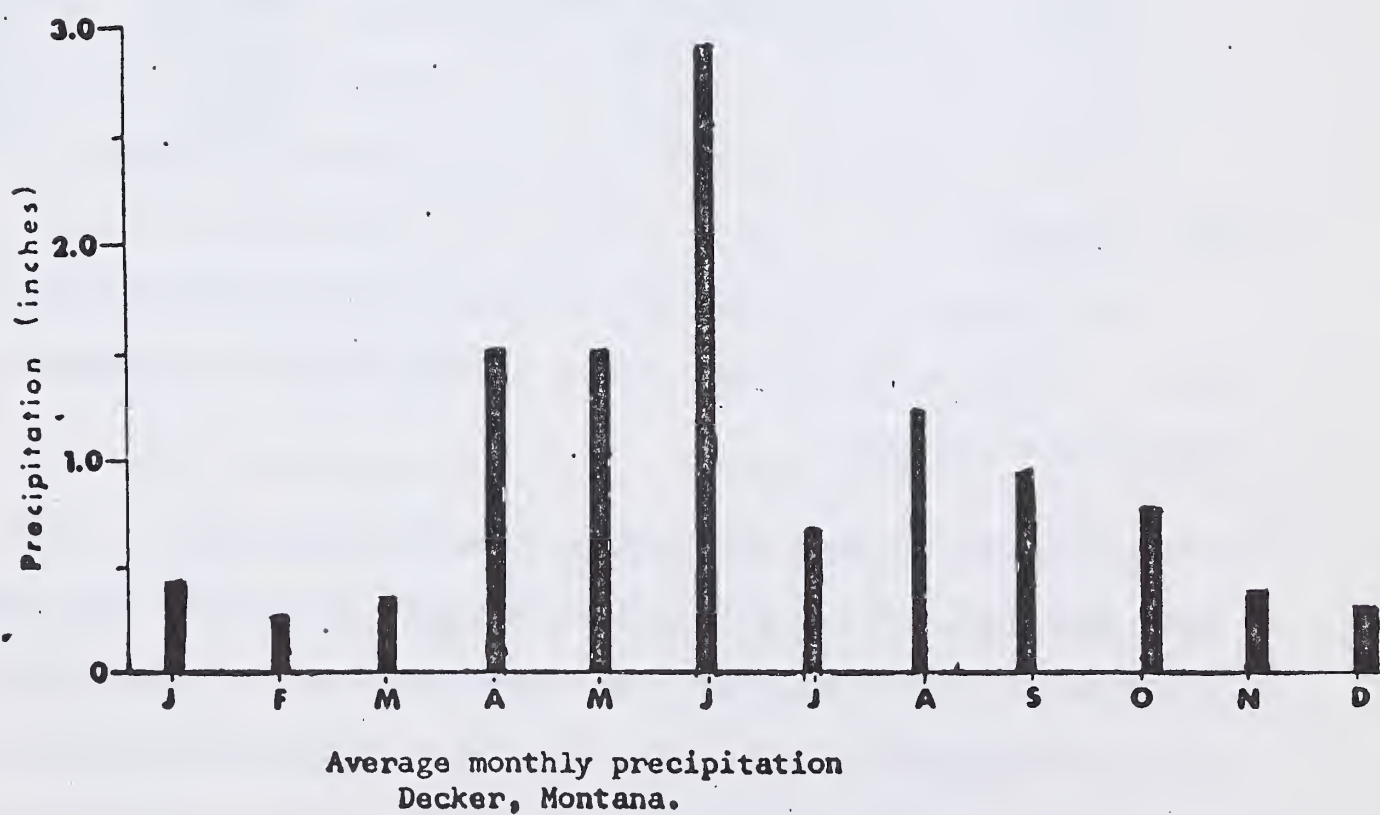
The climate for the Decker-Birney study area has been described in Section 4.1.3. Climate for the project area is also described in the Appendix (1971 Archaeological Survey).

In addition to these descriptions, Figure 12 graphically represents the average monthly rainfall measured at the Decker Mine. The average wind velocity measured at the Sheridan Airport is 8.2 miles per hour (average monthly rate - 6.8 to 9.9 miles per hour); the direction is consistently from the northwest.

FIGURE 12

AVERAGE MONTHLY PRECIPITATION

DECKER, MONTANA



Source: Montana State University Agricultural Experiment Station,
Research Report 21, 1972

5.4 Socioeconomic Factors

Due to the nature of the economic base, the population within the study area is small and relatively stable. Ashland, with a population of 500 to 600 is the largest urban area. Other settlements include Decker (30), Birney (13), Quietus, and Kirby. Big Horn County, in which the mining operation is located, has a population density of approximately two persons per square mile, which may be considered representative of the entire area. Nearly 100% of the employees of the Decker mining operation are residents of Sheridan County, Wyoming; consequently, the influence of the mine on socioeconomic factors is slight within the project area.

The major socioeconomic effects of the Decker Coal Mine operation are in Sheridan, Wyoming. The monthly payroll of the mine is \$110,725, equal to an annual payroll of \$1,328,700. Income tax from this payroll is paid to both the State of Montana and the Federal Government. Montana will realize a total revenue of \$2,868,000 per year both in taxes and other revenue. The following is a breakdown of the State revenues from the Decker Coal Company.

State Revenues

- | | |
|---|--------------------------|
| 1. Personal Property Tax | 12¢ per ton |
| 2. Net Proceeds Tax | 11.0¢ per ton |
| 3. Mine License Tax | 40.0¢ per ton |
| 4. Mine Resources Indemnity Tax | 2.0¢ per ton |
| 5. State Coal Lease Royalty | <u>17.5¢ per ton</u> |
| | 71.7¢ per ton total |
| 6. Montana Share of Federal Coal Lease Royalty: | 37-1/3% of base royalty. |

The effect of the mining operation on employment in Sheridan County may also be expressed by the following unemployment statistics. In March of 1972, Decker Coal Company hired more than 200 employees for construction and related jobs. They were laid off in November of that year. Notice the changes in percent unemployed at these times; they may directly reflect the effect of Decker Coal Company on available jobs and the normal social associated consequences.

SHERIDAN COUNTY UNEMPLOYMENT STATISTICS*

	Total Workers	No. Unemployed	% Unemployed
July 1971	8550	170	1.8
Aug.	8550	196	2.1
Sept.	8550	200	2.1
Oct.	8550	222	2.4
Nov.	8550	324	3.6
Dec.	8550	595	6.3
Jan. 1972	8600	432	4.8
Feb.	8600	525	4.7
Mar. - hire	8600	250	2.7
April	8600	246	2.7
May	8600	196	2.1
June	8600	148	1.6
July	8600	171	1.8
Aug.	8600	165	1.8
Sept.	8600	162	1.8
Oct.	8600	181	1.9
Nov. - layoff	8600	278	3.0
Dec.	8600	475	5.0
Jan. 1973	8650	615	6.3
Feb.	8650	460	4.0
Mar.	8650	360	4.0
April	8650	214	2.3
May	8650	180	1.9
June	8650	152	1.6

*Based on 8550 workers in July 1971 to 8650 workers in June 1973.

The social impacts and employment associated with coal mining have been suggested in the Cooperative Extension Service newsletter dated June 5, 1973, as follows:

"All of the physical changes brought about by the use of coal now lying underground will have some impact, however slight or profound, on people and their society. For individual families a change in their 'way of life' will undoubtedly be the greatest impact. Jobs and population increases from coal development will depend on the number and kinds of enterprises that are established, as well as the scale and efficiency of operations."

The public press section also contains some references to social factors related to coal mining in Montana.

6 BOUNDARIES OF THE AREA WHICH MAY BE SIGNIFICANTLY AFFECTED BY THE MINING OPERATION

6. BOUNDARIES OF THE AREA WHICH MAY BE SIGNIFICANTLY AFFECTED BY THE MINING OPERATION

The boundaries of the area which may be significantly affected by the mining operation may be conveniently subdivided into project boundaries and non-project boundaries.

6.1 Project Boundaries

The existing vegetation, soils, surface and subsurface geologic structures, including the drainage pattern, the D₁ coal seam (Dietz 1 and Anderson seams) and the arrangement of the sand, clay and shale will be directly altered within the approximately 1500 acres of the proposed mine limits. A considerable portion of this area has already been affected.

6.2 Non-Project Boundaries

Non-project boundaries which may be significantly affected by the mining operation include the groundwater, air quality, wildlife, off-site transportation networks, socioeconomic patterns (primarily in Sheridan, Wyoming) and State and Federal economies.

7 ENVIRONMENTAL IMPACTS

7. ENVIRONMENTAL IMPACTS OF THE PROJECT

7.1 General Discussion

In preceding sections of this report, which describe the project and existing environment, a basis has been established by which the environmental impacts can be evaluated.

Impacts may be beneficial, adverse or problematical, and will vary in degree. Beneficial impacts are those that directly or indirectly improve man's environment. Those events that directly or indirectly degrade the environment are adverse. Problematical impacts are those the effect of which is undetermined or has not been tested. Adverse impacts are sometimes unavoidable and require alternatives to reduce or eliminate them; or they can be mitigated by measures which will not significantly change the nature of the proposed project.

In assessment of the impacts of any proposed change to the existing environment, it is important to realize that some activities may have short-term impacts which are forgotten or become minor in importance over a long period of time, while other activities may have less initial impact and yet produce significant long-term direct or secondary effects. Also, all facets of the environment must be considered when evaluating the impact of a particular event. Quite commonly an event can have both beneficial and adverse impacts simultaneously.

Within the time-cost constraints placed on the preparation of this report and in light of all factors involved, the most careful possible assessment of impacts has been made.

7.2 Impacts of the Project

7.2.1 Land Form and Geology

Within the area of the mining operation, there has been a major adverse impact on the environment. The mining operation changes the land form and the subsurface stratification. Approximately 5 million cubic yards of topsoil and overburden have been removed to expose the coal seam. The removal of topsoil and overburden will continue for the lifetime of the project. This will eventually cover an area of approximately 1500 acres, at the rate of 70 acres per year. These changes are a direct result of the mining operation. In addition, construction of the new road, railroad spur line and plant facilities (150 acres) has also disturbed the surface land form but to a much lesser extent.

The texture, quantity and quality of the topsoil from the box cut can be expected to diminish during the time it is stockpiled. No additional organic material or nutrients will be accumulated. The amount of topsoil saved in the stockpiles is also expected to be less than the present total from expected losses due to handling.

The existing drainage patterns have already been changed to divert surface runoff around the mining area. This change in surface drainage patterns has both beneficial and adverse impacts. The primary adverse impact is the alteration of the existing natural drainage pattern (i.e. Pond Creek). The beneficial impacts are related to the mining operation and also water quality. By changing the drainage pattern, the exposed earth is not subject to flooding; the majority of rainfall is diverted around the mine. This also greatly reduces the likelihood of large volumes of water flowing through the mine area without first passing

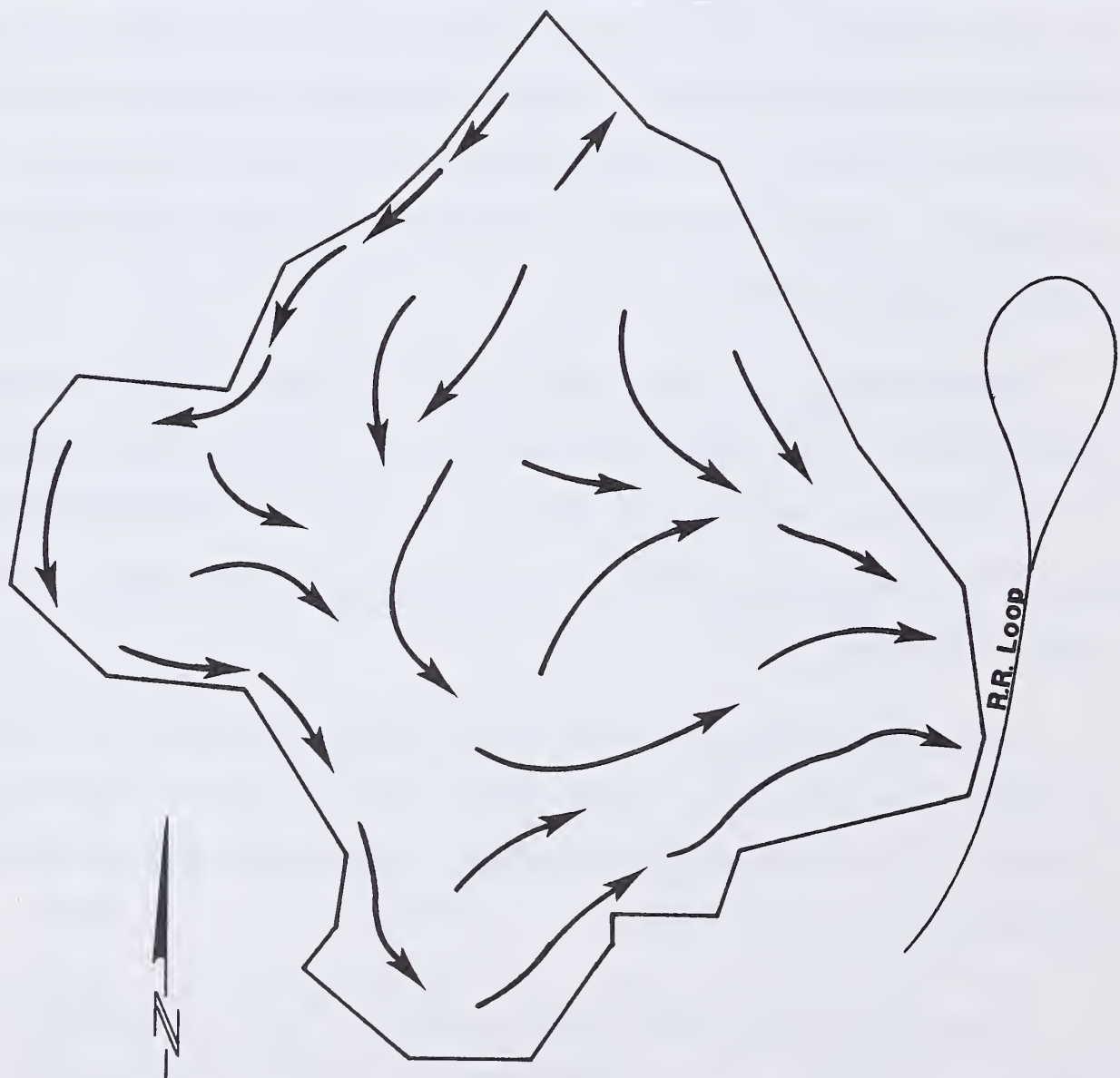
through the settling pond. This pond is designed to remove silt and sediments from the water prior to release into the Tongue River. The drainage pattern after the mining operations have finished is a function of the reclamation plan. (See sections 3.6.4 and 10.4.) The various alternatives which have been described will, in general, maintain some resemblance to the natural drainage pattern by virtue of the simple fact that, as the mining operation extends outward, the depth of the overburden increases. Consequently, the amount of backfilled overburden increases and the general drainage pattern will still be from west to east toward the Tongue River. More specific variations within this general pattern are difficult to predict on the final land use of the area. The land may be used for grazing, agriculture or developed specifically as wildlife habitat. The preferred drainage pattern might be different for each case.

Another generality which can be predicted to affect the final topography is the removal of approximately 50 feet of coal. When the overburden is removed and backfilled, it swells approximately 25%. Based upon an overburden depth of 100 feet, after backfilling, the surface will be approximately 25 feet lower than before.

As presently conceived, the principle differences between the original drainage pattern, which has already been greatly altered, and the final drainage is due to two separate processes: the required handling of the box cut spoils and the final cut.

There will be an elevated ridge of about 60 feet in the region of the present box cut. Inside this ridge, surface water will drain toward the area of the

settling pond. Virtually the entire perimeter of the mining area will drain along the final cut in an arc extending from the northern end and ending near the settling pond. The slope within the final cut will be 0.2%. Between the final cut and the ridge from the box cut spoil pile, water will drain in a similar arc within a gently sloping area. The final contour has also been designed to blend with the surrounding contours. The final elevations range from 3420 feet (near the scraper pit) to 3600 feet (northwest perimeter). This pattern is illustrated in the following scheme:



FINAL DRAINAGE PATTERN
OF DECKER MINE SITE

The overburden, composed of a mixture of clay, sand, shale and sandstone will be replaced in the cuts and graded to a minimum of 5:1 slope. This represents a major adverse impact on the existing subsurface stratification including the D₁ aquifer water course. In addition to backfilling with this mixture of overburden material, the D₁ coal seam will be removed.

7.2.2 Water Resources

Of the two water sources in the area (precipitation and groundwater), the major adverse impact will be on groundwater. The natural D₁ aquifer water course (i.e., the coal seam) will be completely removed from the proposed mine limit. Associated with this will be a decrease in the D₁ groundwater level to an undetermined radial extent. The course of the D₁ water after the mine area is backfilled and regraded is also undetermined; however, it is probable that D₁ water will flow into the broken rock and subsurface soil mixture and flow toward the Tongue River. The groundwater quality may be affected by leachates from the disturbed subsurface geology. However, the D₂ aquifer is only slightly affected and no D₁ water reaches the D₂ aquifer. At the end of the mining operation the volume of underground water presently used for dust control (150,000 to 300,000 gallons/day) will stop. Precipitation is not used as a source of water now. Surface runoff has already been diverted from the project area. At the end of the mine operation, surface drainage patterns will be altered by both the presence of the final cut grading and the presence of possible reservoirs at the final cut. (See Section 10.)

7.2.3 Air Resources

The present mining operation produces dust which is primarily contained on the project site. The operation of vehicles and coal hauling trucks contribute to a degradation of air quality through emissions of air pollutants. The coal has a major beneficial impact on air quality in Chicago and Detroit since emissions are reduced to acceptable limits as described in Section 3.4.

7.2.4 Terrestrial Biology

The vegetation on the project site will be completely destroyed by the mining operation. Small mammals, notably Peromyscus maniculatus, will also probably be killed due to the project. Larger mammals, such as deer and antelope, etc., because of the extended territories (up to 10 to 15 square miles, Burt and Grossenheimer, 1964) are not expected to be affected to any degree.

Studies of the natural history of deer and antelope (Hoover, et al, 1959; Anderson and Jones, 1967 and Whitehead, 1972) indicate that these large herbivores share some similar habitats (shortgrass prairie, mountain and desert shrub). However, there are important differences in food preferences. Deer predominately feed on grasses and browse, whereas pronghorn antelope prefer forbs, cacti, sages and thistles (many species not utilized by cattle). In addition to the large size of their territories, deer are known to migrate long distances (up to 50 miles). Both deer and antelope are commonly observed in the immediate vicinity of the Decker Coal Company Mine. In fact, deer enter the mining area and feed on the alfalfa, clover and reclamation test plants at both the test sites and other disturbed reclaimed areas (R. Hodder, personal communication).

Rodent species densities also have been observed to recover with a return of vegetation related to reclamation efforts. At the reclamation research test site at Colstrip, where large stands of sweet clover are growing, rodents such as moles, gophers and field mice have been judged to interfere with the re-establishment of the vegetation (R. Hodder, personal communication).

The direct effects of the mining operation on large and small mammals may then be expected to differ. Large herbivores will be effected by a temporary loss of vegetation carrying capacity; however, their large territories, ability to migrate and apparent use of re-vegetated areas suggest that this effect will be limited. The presence and densities of rodent species will probably depend upon the reestablishment of vegetative cover used as food and shelter.

On July 31, 1973, based upon a visual inspection trip to Decker mine, personnel from the State of Montana, Department of Fish and Game, Miles City, Montana, stated that the water effluent from the coal mine area did not appear to have any major deleterious effects on the wildlife, vegetation and fish life in the area of discharge or downstream from the waste water discharge point into Tongue River. (Personal communication with Ken Walcheck and Al Elser.)

7.2.5 Transportation

The major impact of the mining operation on transportation is off-site on the various highways used by employees to go from Sheridan to the mine. This amounts to 40 to 50 automobile trips, twice daily, and does add traffic to these highways.

7.2.6 Economics

The operation of the mine has a significant beneficial impact on the revenue to the States of Montana and Wyoming, especially in Sheridan. Montana receives \$2,868,000 per year from taxes and other revenues. Sheridan, through payrolls, receives \$1,328,700 per year income into the city which secondarily affects associated commercial enterprises.

7.2.7 Aesthetics

The major aesthetic impact of the mining operation would be on those persons viewing the mine. The principal visual impacts are the spoil piles, silos and processing facilities. However, the spoil piles are not unlike the surrounding sandstone ridges; thus the aesthetic impact might vary seasonally depending upon the degree of contrast due to vegetation changes. However, aesthetic impact is highly personal, and there will always be a variety of opinions concerning it. This impact is expected to last for the lifetime of the project.

7.2.8 Energy Use

The impact of the mining operation on energy use is two-fold: the energy used to mine the coal and the energy derived from the coal where it is burned. The energy cost in producing the coal is 2,400 gallons per day of diesel fuel and gas and 1.4 million kilowatts of electricity per month. The energy produced by the coal is 9,500 BTU/pound. Based upon these data, and a heat rate factor of 10,585 BTU/kilowatt for conversion of coal to electricity (Commonwealth Edison data), the following simplified energy budget can be developed. More than 400 times as much energy is recovered as is used.

USEPRODUCTION

Fuel: (125,000 BTU/gal)

Coal: 17,000 tons/day

= 300×10^6 BTU/day

= 323×10^9 BTU/day

= 28,300 Kilowatts/day

= 30.5×10^6 Kilowatts/day

Electricity = 46,666 Kilowatts/day

Total: approximately 75,000 Kilowatts/day

7.3 Secondary Impacts of the Project

Because the processed coal is exported from the Decker site, no significant secondary growth-inducing adverse environmental effects are expected within the local area, according to the first annual report of the Montana Environmental Quality Council. In contrast, the report projects that the proposed development of strippable reserves in the eastern Montana region in conjunction with mine-mouth thermal generating stations and ultra-high-voltage (UHV) transmission facilities would have major impacts in terms of growth and degradation of air quality, in addition to other adverse environmental effects. The Decker Coal Company does not expect employment at the mine to increase beyond 200 to 250 jobs during the entire lifetime of the mine. This is a minimum growth-inducing impact. The major secondary impact of the Decker operation is the improvement of air quality within the Chicago, Illinois area made possible by the use of low-sulfur coal. (See Section 3.4.)

Another beneficial secondary impact of major importance will be an increase in the level of information available concerning the reclamation process and the subsequent improvement of rehabilitative techniques. The Decker site will provide an opportunity to observe the relative success of selected reclamation procedures through time. The knowledge gained from this experience will be useful to the strip mining industry as a whole and to the general public, who may ultimately benefit from the results of successful rehabilitation.

8 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

8. UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse effects result from a necessary portion of the mining and processing activities (or related activities) which, in turn, cause a reduction in environmental quality, an increase in safety hazards, an increase in energy consumption, a reduction in biological productivity or the destruction of flora or fauna.

The unavoidable adverse impacts of the coal mining and processing include the complete destruction and removal of surface vegetation and the reduction of associated small mammal wildlife number and diversity. As vegetation is re-established through the reclamation program, these effects may be expected to be reversed. The aesthetic quality of the area has been degraded by increased noise, dust and visual impacts of the spoil piles and plant facilities. However, the major population exposed to these changes are the employees at the mine. Increased automobile and railroad traffic have inevitably increased safety hazards, especially off-site.

Both the D_1 and D_2 aquifers have been affected by the mining operation. The major impact has been on the D_1 aquifer. This water course has been lost due to removal of the D_1 coal seam which is the aquifer. The quantity and quality of this water has also been reduced since the D_1 water is used for dust control and is lost through evaporation. The content of total dissolved solids, sulfate, etc. has increased slightly in the water at the discharge point into Tongue River. Loss of non-renewable low sulfur coal is also a long-term unavoidable adverse impact of the project.

9

**MONITORING AND
PROPOSED MITIGATION MEASURES**

9. MONITORING AND MITIGATION MEASURES

An extensive system of monitoring and continuing study programs have been developed to provide information necessary for evaluating the impact of the mining operation upon important environmental parameters, notably water quality, groundwater, biota, dust and proper reclamation efforts.

The quality of water in the D_1 and D_2 aquifers at various locations throughout the Pond Creek drainage basin, and at the outfall structure and discharge point into the Tongue River, will continue to be analyzed and recorded by the State Bureau of Mines and Geology, Department of Health and Department of State Lands.

The 14 test wells will continue to monitor water pressure and groundwater levels. Additional wells are expected to be drilled, including wells into the overburden so that more precise measurements of the radial influence of the mining operation on groundwater levels, as well as groundwater quality in the backfilled overburden, can be determined.

It is recommended that at the conclusion of mining operation, a reservoir be left in the region of the present scraper pit. The functions of this reservoir would be several-fold. If it is determined that the groundwater will percolate through the backfilled overburden and drain into a reservoir at this point, such a reservoir could provide important information on the impact of groundwater (presumably containing leachates from the overburden) on both water quality and, more importantly, the freshwater biota. Ideally, such a reservoir would intercept the groundwater and contribute significant information to an understanding of the impact of any possible problem due to leachates.

The present drainage diversion channels, dams and settling ponds act to reduce the force of erosion upon the exposed mining area surface and reduce the impact on water quality from the mine.

Levels of dust and other particulate matter in the air within the mine operation are continuously monitored. This program is primarily for worker safety, but it also provides information regarding the dust levels existing during mining operations and might reflect any major change in air quality.

The reclamation research programs in operation at the Decker Coal Mine are designed to provide important information about the plant species selection and soil treatment requirements necessary for proper reclamation. Through continued reclamation efforts which have been described for the Decker Coal Mine and other semi-arid mining operations, it is reasonable to expect that effective programs will evolve which may also have wide application to other land reclamation needs.

Other evaluation studies are still in progress. These include additional overburden analyses, biological surveys, and soil analyses. The information obtained by these studies will add to a more complete knowledge of both the impacts of the mining operation and optimal designs and methods for reclamation.

10 ALTERNATIVES

10. ALTERNATIVES

10.1 No-Action Alternative

The mine at Decker is intended to provide high-quality coal (low sulfur, high BTU) to generating plants in the midwest and east which are required to meet new environmental quality standards. The mining operation must also meet environmental quality standards set by the State of Montana. Any alternative to the project must also meet these conditions to be considered feasible.

One alternative which always exists is the "no-action" alternative. In the case of the Decker Coal Mine, the impacts of "no-action" would be as follows:

1. Electrical generating stations in the midwest would have to find another source of coal capable of meeting air emission requirements.
2. There would be less rail traffic between Decker and Illinois, with a consequent loss of income and employment for railroad employees.
3. The existing income and employment for personnel at the Decker Coal Mine would not continue.
4. The revenue to Federal, State and local governments would not continue.
5. Traffic between Sheridan and Decker would be reduced.
6. The present adverse impacts on landform, geology, soils, etc. would not continue. Decker Coal Company would be required to start reclamation efforts immediately to reclaim land within the present mine limits.

7. The \$24 million required to initiate the mining operation would, in large part, be lost.
8. Depletion of further coal reserves would not occur.
9. Further loss of wildlife habitat and grazing area would not occur.
10. Further use of groundwater, electricity and fuel oils would not occur.
11. Further aesthetic impacts, including dust and noise, would not occur.
12. Further alterations in groundwater levels and water quality would not occur.

10.2 Alternate Energy Sources

Other energy sources that may be practical in the future are in various stages of research and development. These sources include nuclear fusion, breeder reactors, geothermal generating plants, magneto-hydrodynamics (MHD), fuel cells and solar energy. However, current licensing and technological limitations on equipment and materials impose major difficulties.

The development of conventional nuclear power plants in the United States has been slowed by various problems related to licensing, especially questions regarding safety and environmental impacts. For example, identical nuclear power plants built in Japan took 5 years and more than 8 years in the United States (Joint Committee on Atomic Energy, 1973). The San Onofre nuclear power station expansion in California has been unable to obtain the necessary licensing for expansion. Similar situations exist around Lake Michigan, for example, at Zion, Illinois.

The first large-scale breeder reactor (a prototype for electricity generation) is not expected to be "on line" in Tennessee until 1980 (Popular Science, 1973). Controlled thermonuclear reactions have been suggested as the ultimate power source. However, "During 1971, the world's leading fusion experts ... agreed, on the basis of the then-current thermonuclear knowledge, that it would probably be around the year 2000 before economic fusion power could be demonstrated " (U.S. Atomic Energy Commission, 1972). Fusion power is not expected to have a significant impact on electrical power production until the year 2020 (U.S. A.E.C., 1973).

Preliminary study of a possible geothermal source has just begun 20 miles northwest of Helena (Billings Gazette, Aug. 26, 1973). Accordingly, these alternate energy sources are not considered viable alternatives. It has also been stated that the U.S. has passed its peak of productivity of oil and gas and is already dependent on energy resources outside the country. However, this energy shortage is expected to be partially offset by conversion of coal into electrical power (Earth Science Bulletin, 1972).

10.3 Alternate Mining Process

Augering and contour mining do not apply since these methods are limited and normally used on hillsides. Thus, the only alternative to surface mining is underground mining. These may be compared from a variety of viewpoints.

1. ECONOMICS: The economics of mining may be compared in a variety of ways. It has been estimated that the cost of mining coal by surface methods is approximately 2 to 5 dollars/ton, whereas underground mining costs 6 to 10 dollars/ton. The difference is due primarily to labor costs

since surface mining requires fewer workers than underground mining. However, surface mining costs are much greater for equipment than underground mining.

The rate of coal production, expressed per man hour, is also much greater for surface mining than underground mining. For example, the Decker Coal Mine produces approximately 254,000 tons of coal per month and employs approximately 100 workers, including miners and administrative personnel (2546 tons per month per man). In an underground multiple shaft coal mine, 220 employees produce 50,600 tons of coal (230 tons per month per man). Thus, surface mining operations produce more than 10 times as much coal per man compared to underground mining. According to the State of Wyoming Mine Inspector's Report for 1972, underground coal mines in Wyoming produced between 10 and 15 tons of coal per man-day, compared to the average production of coal per man-day at Decker Coal Mine of 115 tons.

It is also stated that underground mines remove 50% or less of the total available coal whereas surface mines are able to remove approximately 95% of the total available coal. Coal has been mined from the Monarch coal seam in northcentral Wyoming by both surface and underground methods. The Dietz Mine no. 8 was an earlier underground operation; vertically they mined seven of the available 50 feet of coal and horizontally they recovered 50% of area. Simple calculations based on this data indicate that recovery of coal by underground mining was less than 10%. In contrast, the Big Horn mine in the same coal seam recovers at least 95% of the coal.

2. SAFETY: The U. S. Department of the Interior, Bureau of Mines, compiles statistics on the safety of mines in the U. S. The following is taken from their reports:

<u>For Period</u>	<u>Fatalities</u>	
	<u>Underground</u>	<u>Surface</u>
1973 (Jan. - Aug.)	52	21

The National Safety Council also compiles statistics on fatalities (set equal to 6,000 days lost) and lost time injuries, and the following is taken from their reports (frequency is expressed in lost time accidents per million man hours and severity in days lost per million man hours):

<u>For 1971</u>	<u>Frequency</u>	<u>Severity</u>
Surface	9.24	1,832
Underground	37.41	4,232
<u>For 1969-1971</u>		
Surface	9.95	2,205
Underground	34.29	4,936

It is readily apparent that both frequency and severity of accidents are greater in underground mining operations, and that surface mines are safer.

3. LAND FORMS: A comparison of the effects of surface mining and underground mining on the land form indicates a primary difference in the ability to control long-term affects. While surface mining completely removes the existing land form, required reclamation programs provide an opportunity to create any desired surface characteristics. Alternatively, underground mining does not directly affect surface land forms except at the entrance and plant facilities site; however, subsidence effects at the surface are difficult, if not impossible to control. There have been numerous examples across the U. S. of undesirable subsidence effects in both natural and urban areas. Reclaimed land from strip mining has been used for reservoirs (Big Horn Coal Mine), game management areas (Knife River Coal Mine, Bismark, North Dakota), as well as for uses such as grazing and agriculture.

"One of the most tragic consequences" of underground mining, in terms of home and business owner property loss, has been the occurrence of mine subsidence in communities underlain by abandoned coal mines (The Pennsylvania Manual, p. 898, 1968-1969). Subsidence at the surface, resulting from collapse of mine roofs into the void created by removal of underground materials, may result in excessive damage in highly developed urban areas. Other types of land use are usually less severely affected. Many types of damage may result: building foundations and walls may be cracked and displaced, railroad tracks may be pushed out of alignment, highways may crack and buckle, bridges may be offset from roadways, water lines may rupture, flow of sewage may be reversed, smokestacks may be tilted, and other industrial equipment or plants sensitive to slope may be affected. Natural drainage may be obstructed or altered to form

swamps, structural failure may be induced in dams, water canals and channels may be rendered useless, and groundwater supplies may be lost through fracturing of the overburden (W. Cochran, Bu. Mines Info. Circ. 8507, 1971). Surface movements due to mining vary widely depending on mining and geologic conditions. Mining thick seams or groups of seams under soft rock sometimes induces intense cracking or caving, whereas mining under hard rock or in steeply dipping measures at greater depths may cause no appreciable movements. The vertical displacement forms a "subsidence trough" which normally extends beyond the edges of the mined area in all directions (G. Brauner, Bu. Mines, IC-8571, 1973). Damage can be reduced or prevented by filling, partial extraction, or leaving pillars. Because the differential movements decrease with increasing depth in mining, safety pillars are largely dispensable at greater depths. Hydraulic backfilling may reduce subsidence by about 50% (G. Brauner, IC-8572, 1973).

10.4 Alternative Reclamation Plans

10.4.1 Relation to Land Use

One objective of Chapter 325, M.S.L. 1973, Senate Bill No. 94, Section 2, is "... to demand effective reclamation of all lands disturbed by the taking of natural resources..." This is a declared policy of the State and its people in keeping with the desire to protect, maintain and improve the State's environment for present and future generations.

In keeping with this policy, the best methods for reclamation of strip mined land must be applied. The best methods for reclamation should be determined by the criteria of final land use. The final land use as set forth in Section 12 of Chapter 325, Session Laws of Montana, 1973, is a suitable permanent diverse vegetative cover of predominantly native species capable of regenerating under natural conditions sufficient to prevent soil erosion and feed and withstand grazing pressure from a quantity and mixture of wildlife and livestock at least comparable to that existing prior to the operation. This criterion determines only one of several possible reclamation plans. The present plans for reclamation of the strip-mined area and plant facilities areas of the Decker Coal Company Mine are oriented toward this final land use. (See Section 3.6.4.) However, alternative land uses are possible, including (1) agriculture, (2) natural habitat exclusive of grazing, and (3) recreation.

These alternative land uses suggest alternative reclamation plans. For example, the preferred topography for agricultural use would differ from that of natural habitat. In the former case, a great diversity of

slopes, drainage, et cetera would probably increase the available micro-habitats and, consequently, the species diversity. Recreational uses may prefer the development of isolated camp sites, hiking trails, and camping facilities.

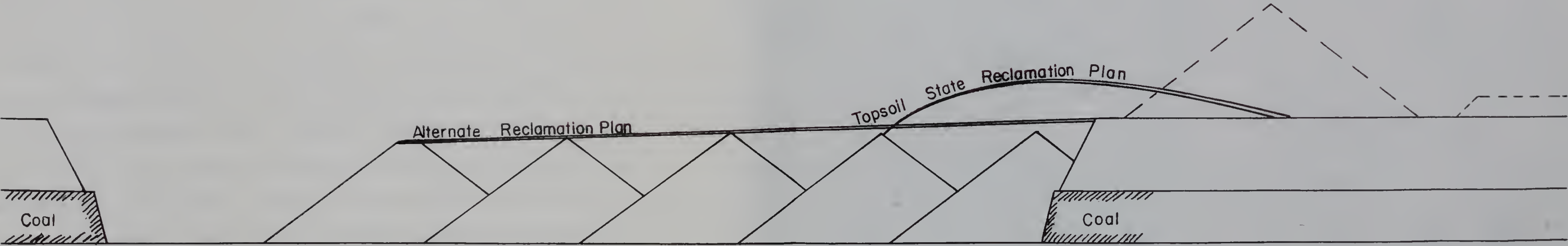
These three alternative land uses also require differences in the vegetative cover. Agricultural land use would primarily grow alfalfa, natural habitat suggests exclusively diverse indigenous plant species, whereas recreational land use suggest clusters of shade trees which can also function to isolate camp sites.

The possible development of stock ponds or reservoirs should also, in part, be determined by the final land use. As diagrammed in Figure 13, the existing general plan for the final cut and highwall reduction will require approximately 125 feet beyond the final cut, and that sufficient spoil excess exist to attain recontouring to a 20-percent grade in compliance with State rules and regulations.

Recontouring highwalls to this plan, however, excludes the development of reservoirs or stock ponds. Providing that there is sufficient surface runoff and groundwater of good quality, water-holding areas could be very beneficial for either grazing, agriculture or recreational uses. A highwall is planned in the area of the present stock pond on upper Pond Creek. (See Composite Map and Section 4.2.2.1.)

If the other conditions for a reservoir are met (i.e., sufficient high-quality water), a water-holding pond in this location could possibly serve as a year-round water source for cattle or supply water for agricultural uses. In order to construct such a reservoir, alternative spoil handling and grading would be required.

FIGURE 14
Schematic of Alternate Phased Reclamation Plan



Original Spoil Pile not Moved until Sixth Cut

Decisions regarding final land use seem premature since mining operations will continue for 20 years. During this time, a variety of social, political and economic conditions may change with a consequent change in the preferred or possible land uses.

10.4.2 Relation to Mining Operations

Because the Decker Coal Company Mine was planned, designed, constructed and initial mining operations, including the box cut, begun prior to 1973, continued operations are in conflict with some sections of the Adopted Rules and Regulations pursuant to Chapter 325, M.S.L. 1973. However, the objectives and spirit of the law are directed toward optimal reclamation practices to reclaim land use after the end of mining operations. An example of one problem area is as follows:

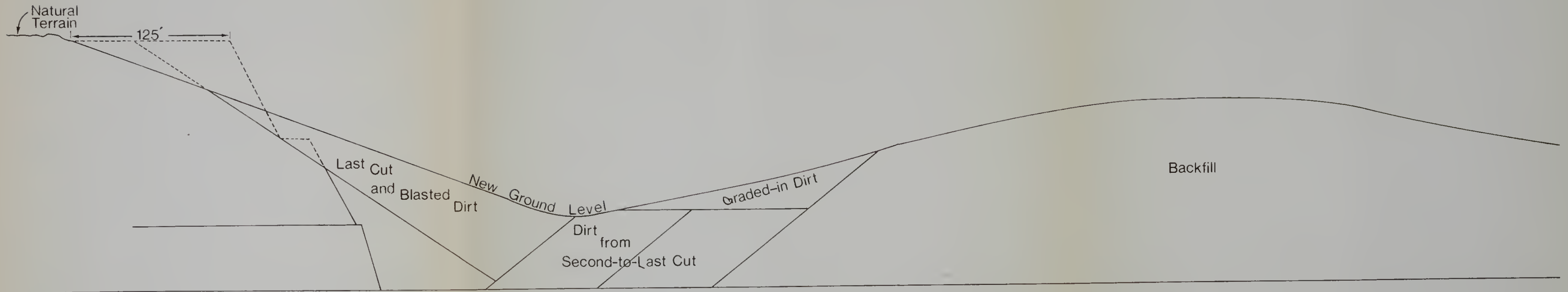
Rules and Regulations pursuant to Chapter 325, Sessions Laws of Montana, 1973, adopted by the State of Montana, Department of State Lands, Section 26-2.10(10) - S10310, Mining and Reclamation Plan states:

"... the grading and backfilling shall not be more than two spoil ridges behind the pit being worked; the spoil from that pit being considered the first ridge. The Department may allow delayed grading of box cut spoils if better recontouring will result."

The following alternate box cut spoil handling (illustrated in Figure 14) demonstrated that if final grading is delayed for four to six cuts, better recontouring and reclamation efforts may result. This is primarily due to the size of the box cut spoil pile. This would have several advantages in addition to better contouring. The first overburden pile from the box cut could be

FIGURE 13

Profile After Backfilling and Reclamation
Final Cut

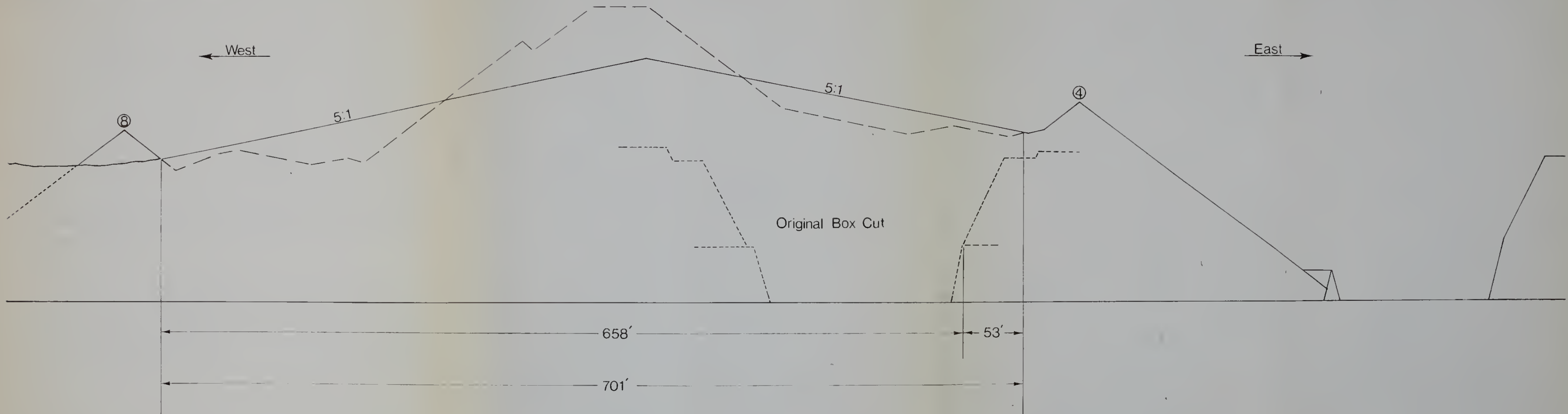


nearly completely removed from the present location and backfilled over a wider area resulting from an additional two to four spoil piles. Consequently, when the coal beneath the existing spoil pile was mined as required by Chapter 220, M.S.L. 1973, there would be less disruption to the adjacent surface where reclamation would have already been in effect for a period of five to seven cuts. In effect, this would minimize the area of land to be redisturbed by surface mining the coal inside the present box cut, which would result in faster reclamation of the land. Actually, this figure demonstrates a fundamental principle: reclamation efforts such as topsoiling and revegetation should not be started until the final contouring is achieved, provided other spoil pile deleterious effects such as dust and wind and water erosion can be minimized. In fact, the requirement of Chapter 220 to mine all the recoverable coal within the mine limits necessitates a second box cut adjacent to the existing box cut. This is due to the fact that recoverable coal underlies the existing spoil pile which will have to be moved. In order to accomplish this, Decker Coal Company proposes to backfill the first spoil pile over four spoil ridges. This will provide space to put the second box cut spoils so that mining operations can proceed inward toward the plant facilities. As illustrated in Figure 15, after recontouring these combined spoil piles to a 5:1 grade, the spoil piles will cover a distance of approximately 700 feet and have a peak height of no more than 60 feet above the original land surface. Only after this stage could final land reclamation begin. This final regrading would effect the drainage pattern over the mining area.

Augering is a mining process which removes coal from an exposed working face by drilling into the seam from the side of the exposed face. Other than exposing the working face, no overburden, topsoil or vegetation is removed.

FIGURE 15

Backfilling and Reclamation of Box Cut Spoil Area



Present augering equipment is limited and can only mine several hundred feet into the seam. Because of the low rates of production and areal limitations, augering is not a feasible alternative. However, if these limitations can be overcome by development of more effective equipment, augering might be a viable alternative to strip mining. It might be especially applicable to recovering coal at the exposed face of the highwall, where overburden depths exceed 150 feet.

Since the mining operation removes a coal seam approximately 51 feet thick, and the overburden (approximately 100 feet thick) swells 20 to 30 percent, the land surface will be from 0 to 25 feet below the original surface. One alternative to this effect would be to import some form of fill material to decrease this lowering of the surface. One fill material might be solid waste from nearby or distant communities. There are several reasons why this alternative does not appear viable: (1) contamination of groundwater by leachates from the landfill material, and (2) the distance from any communities would require additional time, trucks and fuel consumption. Backfilling with earth removed from some other site would also have many of the same deleterious environmental effects as the mining operation, including lowering the surface level.

The grade of the present haul road ramps is approximately 4 percent. As an alternative to a 7 percent grade, this has several advantages. Since the cuts proceed outward in a radial fashion, the existing haul-roads are planned to be extended concomittant with the cuts. The disadvantages of longer ramps

(a consequence of the 4 percent grade) is related to the extent of disturbed area required for longer ramps. However, increasing the grade primarily will cause a change in the length of the ramps relative to the length of the haul roads and will have little effect on increasing the time at which reclamation can begin. The difference in slopes will not interfere with reclamation work in areas between the ramps and haul roads. There are two major advantages of the 4 percent grade, safety and economy (lower fuel consumption). The lower grade has obvious safety advantages during the winter months when the roads may have ice and snow on them. In addition, trucks must turn approximately 90° corners to enter the box cut from the ramps. A more moderate grade will facilitate this turn.

As briefly described in Section 3.5.1, the coal is loaded into the coal-hauling trucks by either a front-end loader or an electric shovel. The electric shovel is used to load coal from the lower half of the coal seam. It raises the coal up to trucks waiting at a level approximately in the middle of the coal seam. This process was selected because of the economy of requiring either the trucks or the electric shovel to raise the coal 25 feet. By reducing the grade, a savings in both fuel consumption (and consequently, air emissions) and truck maintenance requirements will result.

**11 THE RELATIONSHIP BETWEEN LOCAL
SHORT-TERM USES OF MAN'S ENVIRONMENT
AND THE MAINTENANCE AND ENHANCEMENT
OF LONG-TERM PRODUCTIVITY**

11. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

It is not anticipated that the Decker mining operation will cause a loss of long-term land productivity as the result of short-term use. This assessment is based on evaluation of the natural productivity of the site, prior use, and the estimated duration of the current mining activity.

The range of possible uses for the site in its natural state is limited by topography, soils and climate. In addition to its natural function as grazing land for livestock. The anticipated life of the site for mining purposes is 20 years. Continuous rehabilitation during the mining process and immediately following cessation of operation will essentially restore the site to its former use as grazing land and wildlife habitat at an equivalent level of productivity. Maintenance of reservoirs created in the course of the mining operation would enhance the productivity of the site if provision were made for recreational use in the form of fishing, boating, and hunting for waterfowl. In addition, the presence of these reservoirs will also increase the variety of available wildlife habitats and enhance the aesthetic value of the site as open space.

The cumulative effect of the mining operation therefore would be replacement of traditional grazing activities by short-term intensive use of the site for mineral extraction, after which the area would be restored to its former level of productivity, with the possibility of some enhancement of previous conditions.

12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

12. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

12.1 Identification and Commitment of Resources

"Irreversible and irretrievable commitment" refers to the loss or consumption of a resource which is thereby removed from any alternate use. In the case of the Decker Mine, the most obvious resource commitment resulting from its operation is consumption of the coal mined to supply customers, which represents a loss in existing coal reserves. Steel, iron, and other construction materials have already been committed in the development of the existing facilities and equipment. Consumption of fuel oil and related petroleum products (2,400 gallons per day), electricity (1.4 million kW/month), and water (150,000 to 300,000 gallons per day) constitute a resource commitment continuing throughout the life of the mining operation. The Decker Coal Company has invested \$24 million and considerable manpower in development of the existing plant, which represents an irretrievable commitment of economic resources. Topsoil removal, loss of grazing land and wildlife habitat are considered to be temporary resource commitments which may ultimately be reversed through reclamation procedures.

12.2 Commitment Justification

The commitment of resources described in Section 12.1 is regarded as justified because the project will provide a continued supply of low-sulfur coal for production of electricity in Chicago, Illinois, Detroit, Michigan, and other metropolitan areas, resulting in economic and related social benefits to the local area and both the States of Montana and Wyoming. These should also be considered in relation to the required programs to minimize both short- and long-term environmental effects.

13 STATEMENT OF OTHER RELEVANT PLANNING

13. STATEMENT OF OTHER RELEVANT PLANNING

13.1 Decker-Birney Resource Study

The Decker-Birney Resource Study has served as a primary source of information for this report. This study, conducted by the Bureau of Land Management and the Forest Service (Custer National Forest) in cooperation with the State of Montana, is described in Section 4.

13.2 Powder River Basin Report (Preliminary Draft)

This report was prepared by the State of Wyoming Department of Economic Planning and Development, Mineral and Planning Divisions, as the first segment of a comprehensive impact study of the Powder River Basin. This preliminary report is intended as a profile for future growth in the northeast quarter of Wyoming. The information it contains is intended to aid local governments in planning so as to accommodate anticipated growth while achieving regional goals.

The core of the report consists of a series of growth projections for the entire Powder River Basin and the four counties within the region. These projections were based on a series of interviews with private companies which have significant interests in the Powder River Basin. Only part of this information was used in this report. The remaining data will be incorporated in the forthcoming "Powder River Basin Impact Study," which will serve as a planning tool evolving in response to continuous rapid change within the area. The report introduces the statistical projections with an overview of the coal and water resources; the technology available for mining development by new methods, such as coal gasification, liquefaction, and gaseous diffusion-uranium enrichment; and the constraints upon increasing water allocations to the region under the Colorado River, Yellowstone River, and Belle Fourche River Compacts, and previously established appropriative rights. The topography, climate and economy of the area are also surveyed.

The summary of results indicated steady growth in the permanent employment sectors directly associated with mining in the period from 1975-1990, with wide fluctuations in construction employment, which was estimated to peak in 1985. Total employment, including services, was expected to expand at a constant rate of growth. Population growth for the total Powder River Basin was projected at an average annual rate of 3.5% through 1990, in sharp contrast to the slightly more than 1% growth rate during the 1950-1970 period. It was not possible to distribute this growth geographically since the future relationships between communities is not known. However, population projections and socioeconomic characteristics are provided in the statistical profiles developed for the four counties within the Basin: Campbell, Converse, Johnson and Sheridan counties.

13.3 Wyoming Mineral Industries, Review and Forecast

In September 1968, the Wyoming Natural Resources Board commissioned Cammeron Engineers to study the existing mineral industries of Wyoming and project potential development, requirements, and economic benefits to the state. The report was intended to provide background material concerning the mineral sector of the economy, which would be ultimately incorporated in future development of the State Comprehensive Development Plan.

The final report, issued in 1969, consisted of three volumes. Book I-Summary contained results obtained from separate studies of each of Wyoming's major mineral industries, including quantity and market value of production tax, capital investment, employment statistics, and water and power

requirements. This data was then broken down by county, and projections were made from the base year 1967 through the year 2000. Complete studies for each major mineral industry were included in Book II, which included fuel minerals, and Book III, which contained non-fuel minerals.

Summary data related to coal indicated that on the basis of mapping and exploration, Wyoming coal resources amount to 121 billion tons of coal with the total amount of other unexplored reserves unknown. The largest tonnages of coal are located in Campbell, Sheridan, Johnson, and Sweetwater counties.

Wyoming's coal production, which declined drastically when the railroads switched from coal to liquid fuels, has been revitalized by the development of major coal-fueled generating plants in Wyoming. Emphasis has shifted from underground to surface mining operations which have relatively small labor requirements.

On the basis of coal requirements forecast for other industries covered in the study, it is estimated coal production in Wyoming will increase from 4 million tons per year in 1967 to over 350 million tons per year by 2020. A major portion of this tonnage would be used in production of "synthetic" liquid and gaseous fuels by new techniques now being developed and to supply fuel to large-capacity coal fueled electric generating plants. To insure the economic feasibility of the synthetic plants, it will be necessary to use large tonnages of the char produced as fuel in the electric power plants.

13.4 North Central Power Study

The North Central Power Study (NCPS) was conducted as a joint effort by numerous major power supply utilities within the North Central and Rocky Mountain areas. Its purpose was to investigate the power needs and resources of the area through the year 2000 and to determine the feasibility of combining hydropeaking facilities with major thermal plants utilizing the enormous coal reserves in Montana, Wyoming, Colorado and North Dakota. This would be accomplished by constructing large thermal plants at the mine mouths and transmitting power to major load centers by use of ultra-high-voltage (UHV) lines.

The study was initiated in May 1970 by the Department of Interior, which provided technical and professional guidance, and was carried out under the leadership of the Bureau of Reclamation, since the Bureau would play a major role in supplying water to the coal area as well as developing hydropeaking sites. The investigation was carried out by committees and subordinate task forces consisting of technical personnel from the various participating utilities. The final two-volume report was released in October 1971.

For system design purposes, the study area, which did not include the Pacific Northwest, was divided into two sections at the east-west interties located in the Rocky Mountains. The study was to be conducted in three phases: Phase I, cost analysis for the general overall plan using the years 1980, 1985, 1990, and 2000 as a data base; Phase II, revision of Phase I on the basis of information received from each utility concerning projected level of participation; and Phase III, implementation and construction.

The results of the study, summarized in Volume I, showed that further development of the vast coal fields of the North Central region is almost certain. According to NCPS, the water resources necessary for development of these coal resources are available within the region at a reasonable cost. The study concluded that large scale development of mine-mouth generating plants with delivery of energy to the load area by high-voltage lines may be economically feasible, with certain qualifications. These qualifying factors included transmission costs, fuel costs, environmental impact, and the possible increased economic benefit of developing a portion of the generating complex at locations other than the Gillette-Colstrip area, such as the North Dakota coalfield. A brief comparative analysis of this alternative at the 3,000 MW generation level indicated additional generating costs at the North Dakota site would be higher than transmission savings. A combination of generation at both sites or service of some groups from the North Dakota site alone were recommended as meriting further study. It was concluded that if the program under study was implemented, the use of hydro-pumped storage in combination with mine mouth plants would raise the total investment approximately 8% and output capacity by 7.5%.

According to the study, 21 of 42 potential generating sites are located in Montana. The plants would range in size from 1,000 to 10,000 megawatts, which would require consumption of more than 200 million tons of coal annually. Plant size would range from 1,000 to 10,000 megawatts with a total instate steam-generating capacity of approximately 69,000 megawatts, given full development of all sites. The number of employees per site required to operate these plants would vary from 300 to 500 in addition to other support and maintenance personnel.

The North Central Power Study represents the first major compilation of information concerning coal mine reserves in the region studied. Despite the decision not to continue with the administrative and construction phases of the program after completion of the initial report, it has value as an informational resource. The conclusions and data included in the study have been used widely as a basis for projecting potential coal mining development in the study area. It provides both a basis of information to evaluate potential impacts and the realization that those impacts could be of significant magnitude.

13.5 Strippable Coal Reserves of Montana

This preliminary report is part of a series prepared by the Department of the Interior, Bureau of Mines, and various Federal and State agencies cooperating in the planning and development of the Missouri River Basin. This series is intended to locate and determine the extent and character of strip-pable coal deposits in Montana, Wyoming, and North Dakota in response to the current interest in the development of coal resources, particularly the extensive strippable reserves in the eastern portion of Montana. This interest primarily results from the increasing need for electric power coupled with the impending development of economically feasible processes for conversion of coal to liquid and gaseous hydrocarbon fuels, requiring strippable coal reserves of 200 million tons or more.

The report gives an overview of the general region and its geologic characteristics and then proceeds to a detailed description of the location, size, and geology of strippable coal deposits by area throughout the eastern portion of the State, including the Decker, Birney-Broadus, Ashland-Coalwood, and Colstrip-Brandenburg areas in the general vicinity of the Decker-Birney Study area.

13.6 Coal Development in Eastern Montana

This situation report on coal development in eastern Montana was issued by the State Coal Task Force established in August of 1972. It was intended to provide an overview of existing and anticipated coal development in the State and to indicate potential problems arising from this development. The Task Force, which was made up of representatives of various State agencies, was also directed to review existing laws and recommend any changes considered necessary for orderly development.

The Task Force report, "Coal Development in Eastern Montana," was published in January, 1973. The report acknowledged the potential utilization of Montana's coal resources as the most critical problem currently facing the State. Recommendations contained in the report included the following:

1. The State should be given the power to regulate or deny siting and certain design features of energy conversion plants, dams and related facilities.
2. State laws permitting acquisition of surface rights for certain purposes, including mining, under conditions possibly contrary to the public interest should be reviewed and possibly revised.
3. The "hidden" social, environmental, and economic costs which will result from coal development should be borne to the fullest possible extent by the energy conversion companies involved. This is warranted because of the increasing energy demands of the entire nation and by the size and complexity of the problems involved.

4. The Federal government should assume the larger responsibility for potential impacts associated with coal development in eastern Montana by supporting research and providing impact funds to affected local communities.

5. Various water rights reforms should be enacted to protect existing water rights and give the State control over new uses. Also, the Montana Water Resources Act of 1967 should be strengthened.

6. The lack of information concerning resource decisions should be corrected by expanded research, and, whenever possible, irreversible resource decisions should be postponed until this is accomplished.

7. The State should establish long-range natural and human resource planning objectives and institute a planning process directed towards achieving those goals.

8. Adverse social, environmental, and economic effects of mineral development should be minimized, and those types of activities should be encouraged that provide long-term economic benefits to affected localities, as well as the State, in terms of stable employment levels and net tax yield.

9. Deficiencies in existing State strip mine reclamation statutes should be corrected by new legislation providing for increased State control of mining and reclamation methods, including the authority to close mines operating in violation of the law and to prohibit strip mining in selected areas.

As in the case of the North Central Power Study and other comprehensive investigations, this report increased the level of awareness concerning potential impacts of mineral development, which culminated in the passage of more stringent State legislation.

**14 STATEMENT OF THE PROJECT VIEWED
FROM THE BROAD PERSPECTIVE OF
PUBLIC INTEREST**

14. STATEMENT OF THE PROJECT AS VIEWED FROM
THE BROAD PERSPECTIVE OF PUBLIC INTEREST

The provision of energy resources directly affects the economy and environment of the entire market area served by Decker Coal Company, including the metropolitan areas of Chicago, Illinois, and Detroit, Michigan, and may affect other areas in the midwest and east. At a time when the nation is confronted by a potential "energy crisis," continued provision of adequate supplies is increasingly vital. This is especially applicable to low-sulfur coal of the type produced at the Decker Company site. It is in the broad public interest of residents, particularly in the Chicago market area, that this demand for low-pollutant-producing coal be met.

The project can also be considered favorable from the standpoint of local public interest. Since the coal produced would be exported out of the area rather than used at local thermal generator plants, the operation will increase employment and related industrial and commercial activity in the area, thereby strengthening the economic base, with minimal detrimental effects on the local environment.

15

PUBLIC PRESS

15. PUBLIC PRESS

The following articles taken from relevant publications contain considerable information which serves many purposes. It independently documents some of the governmental and citizen concerns regarding conflicts of land use in Montana; reclamation research goals and efforts; economics of coal mining, both costs and revenues and socioeconomic effects. Consideration of these publications should add considerable understanding to the impact of coal mining in Montana.

Copper is king but coal is prince

COLSTRIP, Mont. (AP) - If copper is the aging king in Montana, coal is heir apparent.

Anaconda Co., with its massive open-pit mine on the "world's richest hill" in Butte, is far from dead. But the potential development of billions of tons of minable coal reserves in the eastern stretches of Montana ranchland has already pushed itself into the focal spot of interest in the state.

The Burlington Northern, a railroad with extensive private holdings of Montana coal-producing land, estimates the Treasure State has 132 billion tons of sub-bituminous coal beneath its soil, more than any other state. Of these rich deposits, BN says about 23 billion — 30 billion tons are minable.

The railroad, which mined coal in Montana in 1923-58 to power steam locomotives, has, in recent years, leased its valuable properties to out-of-state and local mining firms, who have been lured to Montana by the low-sulfur content and high BTU (British Thermal Units), which are a measure of potential energy contents deposits.

Ted Schwinden, state land commissioner, says coal production in Montana has jumped from one million tons in 1969 to a projected 17 million tons next year. "There is no question the coal issue is the number one issue in Montana today," he says.

But Schwinden is also quick to add that the surface is hardly scratched in coal development. Even with the mining of 17 million tons of Montana coal, only about 400 acres of the state's 150,000 square miles of land will be disturbed, he said.

How fast the coal reserves

will be depleted seems to be firmly in the laps of Congress and the Montana legislature. Coal companies are eager to set up shop in Montana and only decisions on imposing strip-mining moratoriums or regulated growth are holding back the coal explosion.

Coal in Montana lies mostly on privately owned land, yet mineral rights for this resource are held mostly by federal and state agencies.

A study of 900,000 acres of southeast Montana, the heart of coal country, shows 69 per cent of the land owned is in private hands, with the Forest Service holding 17 per cent, the Bureau of Land Management, 9 per cent and the state, 5 per cent, Rex Colton, BLM district manager reports.

But mineral rights are only 7 per cent privately owned, with the BLM holding 70 per cent, the Forest Service, 18 per cent and the state 5 per cent.

Coal development is definitely a big money proposition — for the developers and government. BN estimates it costs a company between \$15 million - \$30 million to establish a Montana strip mine.

The construction of mine-mouth steam generating power plants, accompanying the extraction, amounts to millions of dollars more. And the development of gasification plants, as suggested by several firms, involves billions of dollars.

Lt. Gov.-elect Bill Christiansen, who has been absorbing coal information for years, and who is considered one of the most knowledgeable Montana public officials when it comes to coal, notes that fees and taxes derived from mining "are

subject to production and the whim of government."

Montana presently receives about 20 cents per ton for coal mined in the state, the same amount the United Mine Workers Union gets for its retirement fund from the mining companies, he said.

Of this income to Montana, about half goes to local government, in the form of a net proceeds tax and property taxes.

The state also receives royalties for coal mined on state-owned lands, in addition to coal license fees and corporate license taxes. Royalties amount to 17.5 cents per ton mined, with a total of \$9 million expected from the workings of the Decker Coal Co. alone to go into the state school fund, Schwinden said.

Colton said Montana received \$2.5 million in royalties from coal mined on federal lands in 1971. Of the royalties paid on such mining, 10 per cent is deposited in the U.S. Treasury, 52.5 per cent goes into the Reclamation Fund (used for irrigation, dam and related construction projects) and 37.5 per cent goes to the state, he said.

Montana uses 50 per cent of its federal royalties for highways and the remaining 50 per cent for the school program, Christiansen said.

Questions raised about coal development consequences include:

—Can reclamation of mined land be assured?

—Even if land is reclaimed will it be restored to the way it was before the mining?

—Will the development of new technology make the mining operations obsolete in providing energy, causing the

boom to bust?

—Will massive influxes of miners shatter Eastern Montana's cowboy culture?

—Will the end of mining in about 30 years create overnight ghost towns?

—Will the water requirements of power and gasification plants kill off ranching and farming?

—Will water be contaminated by industrial wastes from mines and power plants?

But Richard L. Hodder, a coal researcher from the Montana Agricultural Experiment Station at Montana State University, says "reclamation is not the problem."

"The big problem is where to design and build population centers rather than allowing coal ghost towns to spring up," he said. "You can predict the needs of a population center, but you cannot predict the needs of a whole raft of scattered trailer towns."

Hodder, who has conducted a series of coal-company-financed reclamation studies, favors slow development of Montana's resources "to tame the coal monster" rather than the setting of a moratorium on mining until all reclamation problems can be worked out. He estimates an efficient reclamation project should cost a mining firm less than \$500 an acre.

Montana government, new to the complexities of coal-mining reclamation legislation, adopted a measure in 1971 allowing the Department of Lands to enter into reclamation contracts with mining firms.

A new bill, still in the draft stage, would give the state much broader powers and is considered, by State Land De-

partment officials, to be the toughest strip-mining bill in the nation.

John Henson, staff attorney for the department, said the bill would give the land agency full control over the entire mining operation, not just the reclamation process. He said the bill allows for selective denial of mining permits and gives the state the power to call an immediate halt to any mining in violation with the statute.

In addition, citizens would be given the right to act to recover damages for injuries to ground-water supplies and from contamination of water from mines.

Christiansen said he would also require companies to make "reasonable recovery of all deposits." This, he said, would prevent mining companies from taking only the best of the coal for immediate needs and being forced to re-open mines in the future to extract the remainder of the ore.

He would also require payment of an annual \$500-\$750 fee for each acre disturbed by mining. The payment per acre would be required until companies removed their state bonding requirements by reclaiming the mined land.

Present major mining operations in Montana are carried out by Western Energy Co., Decker Coal Co. and the Peabody Coal Co. Westmoreland Resources is building mining facilities and Consolidation Coal Co. is actively considering Montana operations.

Paul Schmechel, vice president and general manager of Western Energy, a wholly owned subsidiary of Montana Power Co., says his firm is mining 5.5 million tons of coal annually from one 25-foot thick seam near Colstrip. He said 120 acres are disturbed each year by this mining for firms in the Midwest and for Montana Power's plant at Billings.

In five years, Schmechel says his mines will be producing 11.5 million - 12 million tons of coal, disturbing 240-350 acres annually. He said Western Energy lands, on which two seams of coal lie, hold 850 million tons of minable reserves, 350 million tons of which have already been contracted for. The company also has coal holdings near Miles City, he said.

Joe Lake of Denver, surface operations manager of Peabody Coal Co., a wholly owned subsidiary of Kennecott Copper Co., said his mines near Col-

strip are producing 1.5 million tons of coal annually, disturbing 40 acres each year. Unlike Western Energy, Peabody is mining both seams of coal, he said.

In five years, Lake said, Peabody will be mining four million tons of coal annually, disturbing 100 acres a year. He said the firm is committed to supplying 100 million tons of coal to buyers out-of-state. Peabody also has coal reserves in Wyoming, Utah, Colorado, New Mexico and Arizona, he said.

George Nugent, general manager of Decker Coal Co., a partnership formed by Peter Kiewit and Sons and Pacific Power and Light, said there are over one billion tons of minable coal on land leased by his firm just north of Sheridan, Wyo., across the Montana border.

Mining on a 640-acre tract of land leased from the state is expected to yield 90,000 tons of coal an acre from the incredibly rich 55-foot thick seam of coal.

The firm spent \$24 million establishing its Decker mine and is yet to extract one million tons of coal from the recently begun diggings, Nugent said. There is enough coal on the

state land to mine eight million tons a year for 20 years, he said. Presently, the firm is committed to deliver four million tons annually to the Midwest, according to Nugent.

Schwinden says relations with Decker have been "excellent."

Tripled coal tax passed by Senate

HELENA, Mont. (AP) — A measure tripling the tax per ton on surfaced-mined coal in Montana cleared the state Senate Saturday following an hour and 15 minutes of bitter debate.

Attempts to lower the proposed level of taxation on the state's booming new industry failed by a 36-14 vote. An attempt to add five cents per ton in taxes to the two top-quality grades of coal mined in the state failed on a 25-25 vote.

"We must determine our own destiny unshackled by coal, unshackled by oil and unshackled by copper," said Sen. Luke McKeon, D-Anaconda. He fought an attempt to reduce the proposed taxes by up to eight cents a ton.

"To further destroy that tax is to destroy the fiscal integrity of Montana," he said. Earlier last week, the Senate Taxation Committee chopped five cents a ton from the House-passed bill in the highest categories of coal and lowered the tax on the lowest quality of coal by six cents from the House version of the measure.

McKeon accused the coal industry of using scare tactics on the legislature. He said coal company claims that the proposed taxes would worsen Montana's competitive position with Wyoming coal producers were designed to force legislation based on fear.

"It's like the kid who says that if he can't win the game he will take his basketball and go to the sanctity of his bedroom," McKeon said.

Sen. Archie M. Cochrane, R-Billings, unsuccessful in an attempt to reduce the tax propos-

al, told colleagues: "We are cutting off new business in the state before it can get started. We have to give a new industry a chance to get off the ground."

Sen. Herbert J. Klindt, R-Billings, agreed. "There are some who would prefer no mining," he said. "If these new taxes are imposed, they may well have accomplished their purpose."

The tie-vote that killed the attempt to restore the taxes to the manner in which they cleared the House was almost strictly along party lines.

Helena Republican James T. Harrison Jr. sided with Democrats seeking the increase. But Democratic Sens. C. R. Thiessen of Lambert, Gordon McGowan of Highwood and David James of Joplin voted with Republicans.

Said McGowan: "If you want to kill an industry, shoot it—don't cut its throat and let it bleed to death."

Klindt said the tax measure carries an ominous message to coal companies. "We are saying 'we don't like you, we don't want you, get out of the state.'"

McKeon said Montana is not in competition with Wyoming in coal development. "If Wyoming wants to revert to the period of Montana history where the copper barons rode roughshod over our state so be it," he said.

The bill that returned to the House for consideration of Senate amendments taxes coal on the basis of its energy-producing value measured in British Thermal Units.

It raises the tax on top-grade coal to 33 cents a ton from the

present level of 10 cents a ton.

The next highest category would be raised to 27 cents a ton from the present eight cents a ton.

The third grade of coal would be taxed at a rate of 22 cents a ton instead of the present six cents a ton.

The lowest grade of coal would be taxed at a rate of 12 cents a ton instead of the present four cents a ton levy.

Wyoming's top two grades of coal are taxed between 19.2 cents a ton and 17.6 cents a ton, Klindt said.

The bill also levies an additional one-cent-a-ton on all categories of coal for purposes of administering a mined-land reclamation law.

A companion bill was also heatedly debated but Democrats succeeded in delaying action on the measure when it appeared they would not be able to keep it alive.

The bill would remove the right of a mining company to deduct the costs of reclamation in computing its net proceeds tax to counties. That tax is paid in lieu of property taxes.

Supporters say the measure, if killed, would require county property taxes to subsidize reclamation.

Opponents say the measure is a swat at coal companies. They argue that reclamation should be encouraged by special tax incentives.

Sen. Frank W. Hazelbaker, R-Dillon, a critic of that measure, said: "We are drawing a bead on the big goose. But we will wind up killing all the little ducks."

Can ranching, mining coexist?

By GARY LANGLEY
Gazette State Bureau

BIRNEY—A rancher's life on this hot, dry rangeland is just as unyielding as ever, but the ranchers want to stay.

However, they disagree over whether coal development is a device to keep them here or a wedge to drive them out.

The former view is held primarily by those who have rich deposits of coal under their land and see lucrative royalty payments as tools to improve their ranches.

The latter opinion comes from those who are not so rich in coal—but consider their lifestyle in this secluded country as their wealth. They say their land would be devastated by the giant coal-seeking draglines and their lifestyles destroyed by a booming population that the coal will attract.

Fifth in a series

"We can improve our business and save it for our grandchildren with the coal money," he said.

BROOSTER, A heavysset man whose grandfather settled here in 1882, finds quick comradeship in Marcus Nance and A. F. Hayes.

They own two-thirds of a family complex of three ranches that covers 43,000 acres and runs 3,000 head of cattle. The sprawling corporate rangeland is rich in coal deposits that Nance estimates could bring his family \$30 to \$40 million in coal royalties.

Although they value their way of life, they contend they are pressed by hard times and a tight cattle market, and they need the coal money to improve their ranches and lifestyles. It is a goal, Nance contends, "which you can't (realize) in the ranch business."

"This cow business has gone up and down," he said. "We're not going to get \$650 for our calves forever."

Adds Hayes: "I think one thing that bothers us all is we're going to have the miseries of mining—we might as well have the benefits."

THEIRS IS NOT a unanimous opinion.

Wallace McRea, a rancher north of Colstrip, estimates that he has strippable coal under one-third of his 27,000-acre ranch. But he does not talk about royalty money, and he is not interested in leasing it to coal companies.

"As far as it being a viable economic unit, it would eliminate it," he charged. "There's no such thing as a free lunch. You can't have

(coal development) and your outfit."

Don Bailey, who owns a ranch near McRea's spread, says: "I think they'll find out they were wrong—and it's going to be too late when they do."

The new range war among ranchers is one that has erupted in several areas of eastern Montana. It is most pronounced in the Birney, Colstrip, Bull Mountains and Sarpy Creek areas.

Basically, the conflict boils down to the value these ranchers place on their way of life.

"**WE'LL BE AN** industrial area, and we'll be just like any industrial area," Bailey intimated. "The sad part of this whole thing is when they realize what's happening it's going to be too late. We're on an irreversible course right now."

Moreover, ranchers near Colstrip contend that they are more aware of what strip mining will do because they live in the shadow of two large mines operated by Western Energy and the Peabody Coal Co.

"All we have to do is look over the hill," McRea said.

However, ranchers on the other side of the issue are no less concerned about their lifestyles and what one described as "the pollution of people."

"I think everybody out here cherishes this way of life," Nance said. But he added: "How the hell do you put a value on a way of life? I don't think any of us are thinking about money."

HE AND OTHERS who favor development consider coal mining as the coming thing, and contend the only remaining question is how extensive the changes will be.

"It's already changing—it's going to change more with the coal money," Nance said.

Hayes said, "Our way of life will change—but not our lifestyle."

Opponents of development disagree over the extent of change, but they are no less resigned to it.

"I think you're going to see a very rapid change from a rural agrarian type of society to an urban industrialized society," one rancher said.

BURTON BROOSTER, 70, and approaching retirement, wants to pass his 24,000-acre spread on to his grandchildren. Coal beds lie under a substantial portion of his ranch, and Brooster figures to make \$3 million in royalties if the coal is mined.

In simple paper and pencil calculations, Brooster has figured his potential income like this:

The grazing capacity of his land is 36 acres per cow per year. He estimates nearly 1.3 million tons of coal is buried under the same 36 acres; and with a royalty of 20 cents a ton, the land would yield \$253,000. He could sell a cow for \$400.

And Bailey said ranchers would be unable to "coexist with the coal people."

Ranchers like Bailey and McRea foresee their cattle country shrinking in the wake of the draglines.

"**NOBODY IN** their right mind would come here and buy this for agricultural purposes," McRea said.

He added that while development will cause a short economic boom, "the sociological costs are going to catch up" once the mining ends.

As for physical damage, the opponents are more concerned about the possibility of energy conversion than strip mining itself.

"I don't think strip mining is as bad as power plants," one rancher said. "That's the thing nobody wants."

They blame their plight on what they say is a fabrication of the energy shortage.

"They have sold this to enough companies, and the energy companies are operating on the premise that they're going to do what they want to solve this energy crisis," Bailey said. As a result, he added, "the majority of the people in Montana want this thing."

ON THE OTHER side, those who favor development do not view its effects as seriously and cite the energy crisis as good reason for development of eastern Montana's coal deposits.

"I think 220 million people in this country are going to be heard from when their light goes out," Hayes said.

And Nance contended, "there wouldn't be any market for our coal" if, in fact, an energy shortage did not exist.

They also contend the extent of potential development has been exaggerated when, in fact, only 10 to 15 per cent of the area's rangeland sits atop economically strippable coal.

"Naturally if we thought 50 per cent of this country was going to be turned upside down we would object to it and we wouldn't like it," Brooster said.

Nor does environmental degradation by strip mining or power plants concern them greatly.

"If we can send men to the moon we can be sure as hell take care of the pollution coming out of those power plants," Brooster said. "We inherited this coal from the dinosaurs—who are we saving it for—the martians?"

Thoughts of a strip mine worker

Editor's note: Following is the text of a letter that a heavy equipment operator from Billings now working in the strip mine coal fields of Eastern Montana wrote to his family. We believe it conveys a feeling that many have.

By DONALD WALLIS

Just a line or two. I've got something on my mind and want to put it on paper. I saw a little history being made today. The first train load of coal was loaded out today in this little out of the way place called Decker, Mont.

Something over a hundred cars were loaded out and rolled down a new railroad track to a destination unknown to me, but it put this place called Decker on the map.

NOW I'VE SEEN history in the making for a little over 40 years, but not too much that would be recorded. Just little things that you and I would know and remember.

This episode today to me is big. Because I can remember Decker from the time I was a little boy. Driving through in an old Model T, going to my aunt's house. It was just a store, post office and a gas pump then. One of those pumps you had to fill by pumping a handle on the side.

TO A SMALL BOY then it was a wonder to watch the man pump the handle and watch the pretty gas fill and splash up in the glass on top.

We stopped if we went this way more for water than gas and to pass the time asking about the roads further on.

You see the roads weren't really roads then, just a leveled trail down through the sage brush. Water was important as there wasn't much out in these hills then.

There weren't many wells even then as it was expensive to hire a well driller and very slow drilling to hit water as it was very deep in most of this country.

YES, I CAN remember as a small boy these things and a town called Decker because I'd been there. Too many people, they'd never even heard of the place until now.

To the uninformed, they still don't know, but after today if the news media has its ear to the ground, it'll be news all over and people will say, "Decker, where is that? Oh, it's down in the southeast end of the state somewhere."

And people will come to see and settle and build and other people will come to see and visit.

A YEAR AGO or just a little over now, I saw this area of grassland and cattle, sheep and wild life now transformed by a railroad, buildings, water towers, a new highway being built. Great holes being dug into the ground to uncover the veins of coal.

Giant earth movers being built and others running back and forth moving the earth and coal. It hasn't hurt yet.

This morning on the way to work, we stopped and watched deer feeding in the alfalfa patches along the road. The fawns were trying to nurse, but the mother was too nervous so she kicked them away.

IT'S JUST a beginning so they say, but we'll have to watch in the future for population brings poachers and they are hard on the wild life.

I believe that we can still have this industry and our wild life, too, if we work together.

Well, I'm helping in my small way to build a giant earth mover to uncover the coal and to scar the land, but I'll do my part in my small way to try to get people to reseed the land and use it again some day for cattle and wildlife.

Such is history being made here in Decker today.

Town of Colstrip being built to last

By GARY LANGLEY
Standard State Bureau
(Last in a series)

COLSTRIP — Even to the most casual observer, this town is living evidence that full-scale coal development in Montana will not stop with strip mining.

This is a company town in which a commercial area, residences and recreational complexes are being constructed with the steel framework of a 350-megawatt generating plant in the background.

It will be finished in 1975, and another is scheduled for completion a year later.

Together, the coal-fired steam plants represent a \$183 million investment by the Montana Power and Puget Sound Power and Light companies.

The Montana Power Co. maintains the plants are necessary to provide its customers with adequate and reliable electricity.

But it won't last for long. Two other plants, currently in what officials describe as the "discussion stage," are scheduled to be in operation by 1979.

THE ONLY EVIDENCE of such grand plans so far, however, are the huge steel beams, rising more than 200 feet into the air, that will support Unit 1.

When it is completed in 1975, coal will be placed into silos and pulverized into dust. The dust then will go into a boiler where water will be heated by the coal until it is converted to electrical energy in huge generators.

More than 360 men currently are involved in the construction effort, and construction crews are expected to peak at 800 men within a year. They presently are being housed in a barracks and temporary trailer spaces, but the town is assuming an air of permanence.

A **COMMERCIAL** area is being built at one end of town, although a half-finished motel is the only building under construction so far. Nearby, several apartment houses are under construction to house part of the work force of 550 persons who will be involved in mining and power generation.

A number of single family houses already have been built and a large trailer court has been prepared for mobile home dwellers.

Mike Hayworth, a tour guide at the plant site, describes the new Colstrip, which had a population of 100 only five years ago, as a "pleasant community."

"It isn't going to be the old time commissary, company town," he said.

Projections show the town's population will reach a peak of 1,860 next year during the height of construction, and level off at 1,780 in 1980.

That will mean a tremendous impact on such services as schools, churches, health care and police and fire protection.

Western Energy, which operates the Rosebud mine near here, intends to assume the responsibility for police and fire protection and will provide space for a medical-dental center. Although the company considers provision of additional school facilities as a "public function," it intends to inform school officials of the anticipated impact on enrollment.

Individual, businesses and residences apparently will be privately owned.

Those involved in coal development here boast that the total annual payroll will be about \$5 million and provide jobs in other related fields such as the railroad industry.

HOWEVER, WITH such rapid growth comes problems.

Even with extensive replanning, the social impact that will be caused by the population boom in such an isolated area remains uncertain. And environmentalists are concerned about potential water use problems and air pollution that will be caused by the plant, although company officials insist neither should be of concern.

With the advent of full-scale coal development, the power plants here will not be the only ones constructed in eastern Montana. It was with that in mind, that the State Legislature passed a power plant siting act last winter to regulate construction of the plants as well as the transmission lines that will result from them.

Montana contains an estimated 21 potential sites for such plants. Full development of all the sites would mean a generating capacity of about 69,000 megawatts.

While long range plans are nebulous several companies have expressed interest in constructing power plants.

IN THE DISTANT future, gasification — the process through which coal would be converted to gas — looms as a possibility for Montana. The plants, which consist of four units, require investments of \$1 billion and would consume seven million tons of coal and 17,000 acre feet of water each a year.

Despite the huge requirements, energy producers have indicated interest in constructing such plants. The proposed sites are Bloomfield in Dawson County, Hardin, and the Crow and Northern Cheyenne Indian reservations.

Coal liquefaction is another possibility, but thus far no processes have been developed to make them competitive with petroleum products. At the present time, no such plants are known to be planned in Montana.

Culture impact of coal work already shows

11/20/72

By STEVEN P. ROSENFELD
Associated Press Writer

HELENA (AP) — The entire reclamation division staff of the State Department of Lands has returned from a week-long inspection of coal and bentonite country and reported Tuesday that eastern Montana's "cowboy culture" has already been intruded upon.

John Henson, staff attorney, said "the cultural impact of coal development that has been projected for the future is already there. Trailer courts are springing up and motels are full of coal and railroad employees."

Six land department officials and an official of the federal Soil Conservation Service toured eastern Montana last week with Elmore C. Grim, surface mining specialist of the Environmental Protection Agency and for eight years director of the division of reclamation of the Kentucky Department of Natural Resources.

Ted Schwinden, land commissioner, said prospects have brightened for federal government assistance in coal and bentonite reclamation research since the tour. He said Grim seeks a late January meeting with Montana officials in Helena to work out the details of federal funding.

The tour took officials to Bull Mountain coal deposits near Roundup, Western Energy strip mining efforts at Colstrip, Westmoreland Coal Co. operations south of Hlysham along Sarpy Creek, Decker Coal Co. mines at Decker north of Sheridan, Wyo., Peabody Coal Co. fixtures near Colstrip and Hallet Minerals Co. bentonite diggings at Vananda northwest of Forsyth.

to fit that category is Bull Mountain, being considered by Consolidation Coal Co. for a strip mining operation.

"I can't see a reasonable need to mine that area unless there were a national emergency requiring every available source of coal," he said. Henson noted that the BTU content (British thermal Units are a measure of energy potential) of the Bull Mountain deposits is the highest in the state.

But he said the nine-foot thick deposits don't compare with the 50-foot seams of coal that are found elsewhere in less steep areas of the state.

Grende said "most reclamation problems in the state can be resolved through the cooperation of the coal companies."

Pat McKelvey said many companies have now incorporated reclamation into their mining operations, and as a result, have better and more effective reclamation programs.

Schwinden said "if reclamation is an afterthought it costs the company more and doesn't work as well."

The reclamation division staff said Grim calls a proposed Montana reclamation bill "the toughest legislation on strip mining in the United States."

The draft legislation, to be submitted to the next session of the state legislature, would revise the Montana Open Cut or Strip Mined Land Reclamation Act adopted in 1971.

The proposed bill would give the land department control of the entire mining operations. Henson said this would allow the reclamation division to plan

Southeastern Montana bentonite deposits are currently disturbing as much land as coal development, Mike Grende said. The mineral clay, owing its name to Fort Benton, is used as a binder in numerous industrial processes.

Schwinden said the department is using information gained in the tour to draft letters to coal and bentonite company representatives summarizing impressions of their operations and reclamation efforts.

"It is fair to say that all companies have now agreed that surface soil materials will be removed from an area that is to be mined and stockpiled for replacement following mining," he said. "There is also a consensus agreement that mining spoils will be reduced to 20 per cent grades in most areas of the state and, at the most, to 33 per cent grades in high wall areas."

Schwinden said that effective reclamation only requires "public support, good laws and effective administration of those laws to get the job done." He said full recognition is needed that some areas should not be mined because the cost will be greater than what the public is willing to pay.

Henson said one of the areas

for restoration of mined land in the mining process. The current law, he said, gives the state control only of the reclamation process, which gives the state a voice only after the mining is completed.

Other provisions of the bill would give the state the power of selective denial of mining operations where circumstances warrant and authority to halt operations immediately upon determination of a violation of the act. The bill also would raise from \$1,000 to \$5,000 the required bond posted per acre of land to be reclaimed.

Reclamation division personnel said the tour allowed a great exchange of information between Grim, who pushed through a stringent Kentucky reclamation act in 1966, and staff members.

Grende said Grim rated Decker Coal Co. "as standing out as the most modern coal mining operation in the nation."

Schwinden said a note of encouragement was the inauguration by the Peabody Coal Co., during the tour, of a \$100,000 scraper to store top soil in the areas to be mined.

"By and large, most companies are cooperating with the state," Schwinden said, "some a little more than others."

Coal means business in Forsyth

The Billings Gazette

Sunday, December 31, 1977
Morning Edition

By MICHAEL WENNINGER
Gazette Staff Writer

FORSYTH—Coal mining and coal-fueled power plants are good things to the people of this town, the largest on the highway between Billings and Miles City.

Apparently nobody thinks they should be forbidden, although most people believe they must be watched closely to keep them from getting out of hand.

Forsyth is about 30 miles north of Colstrip (pop. 500), a company town where Montana Power Co. is building what will be the largest steam-electric generation plant in Montana. To fire the big boilers, coal from the neighboring strip mine will be used.

The mine is operated by Western Energy Co., a subsidiary of MPC, and it is the same mine from which Burlington Northern hauls 15,000 to 16,000 tons of coal daily to Illinois and Minnesota to feed power plants there.

COLSTRIP COAL also is hauled to Billings to be burned at Montana Power's generation plant there.

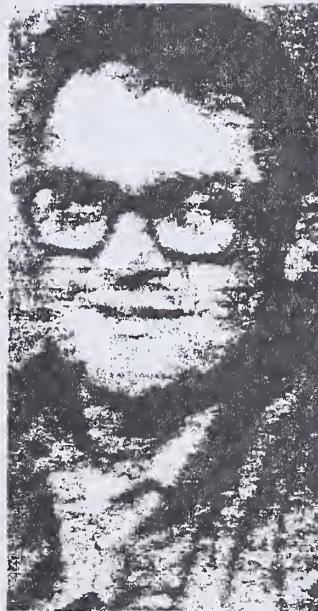
Seven miles south of Colstrip, Peabody Coal Co. continues to operate the strip mine it opened in 1970. Burlington Northern hauls that coal out of Montana, too, starting the trip on the same spur line that serves Colstrip.

All the activity in the Colstrip area is good for business in Forsyth. Very good.

Although the townspeople want coal development to continue they express concern for farmers and ranchers who might be affected by pollutants from the power plant—or plants if more are built. After all, Forsyth is the seat of Rosebud County, a vast, sparsely populated, sprawling area with an agriculture-based economy.

It seems, however, that a bare handful of ranchers in the Colstrip vicinity are worried.

THE MANAGER of the Grain Terminal Association's feed plant here, Lynn Taylor, 29, said



LYNN TAYLOR

he has not heard any talk among his customers of possible harmful effects of strip mining or power plants.

Taylor commented that although most of the area consists of cattle ranches, "there are some pretty good size wheat ranches around Forsyth."

He said protection of water rights for irrigation could be a problem if reports of possible water consumption from the Yellowstone River by power-generation complexes proved true. He added that he really didn't know much about the potential water situation.

Businessmen in town talk about a boom.

Karl Heberle, 40, one of four brothers who operate Tepee Motor Co., the Ford-Mercury dealer, said, "It has really helped our business, and after all, that's what we're here for."

"This is going to be the best year we've ever put in here, and we've been here 13 years. With this Colstrip deal, we have outgrown our facilities, especially our shop. We're going to have to build or add on."

HEBERLE has been on the four-member town council more than two years, is a past presi-

dent of the Chamber of Commerce, and is now vice president.

"The town itself is just about bulging at the seams now," he remarked. "There isn't a vacant house in town."

Heberle was asked whether Forsyth's growth is causing problems.

"Not so much yet, but it's coming," he replied. "Morrison-Maierle (a Helena consultant engineering firm) is doing a survey to see what we need to keep up."

Should a power plant be built at Colstrip? He was asked.

"I don't know, I really just don't know," Heberle replied.

HE EXPLAINED that some ranchers and farmers, who he



ESTHER DEAN

Mrs. Dean said the effects of strip mining in Eastern Montana cannot be compared with the aftermath of mining in West Virginia.

"The terrain is entirely different," she remarked. "In West Virginia there are very deep valleys and steep runoffs."

Mrs. Dean said her mother-in-law was the first white child born in Forsyth (in 1882). She said her father-in-law, Walter Dean, and Freeman Philbrick were "probably the most active participants in getting Colstrip started."

DEAN TOOK PHOTOS of coal outcroppings in the area in 1912 and he and Philbrick helped interest the Northern Pacific railway in starting mining there in 1923, she said.

Mrs. Dean added that she and her husband own a quarter-section of land adjacent to the Colstrip mining site.

As for construction by Montana Power of a generation plant at Colstrip, Mrs. Dean commented:

"I feel a power crisis for the United States is in the offing. People won't be willing to give up many of the things power



KARL HEBERLE

called the backbone of his business, fear the plant's emissions would harm their grazing lands.

Esther Dean, 54, head of the Rosebud County Library and a Forsyth resident for 32 years, said beneficial coal development "can be done and the country can be kept in shape."

"We need the population. We have to broaden the tax base. We have to do something for the Montana economy," she said.

life.

"I feel that using the coal is the thing to do."

Is she concerned about air pollution?

"I'm not particularly worried about it ... I believe the pollution factor can be controlled," Mrs. Dean replied.

SHE WAS ASKED what would happen to Forsyth if the coal boom fizzled after about a quarter-century. Mrs. Dean said she believed 20 or 30 good years for Forsyth would be better than nothing, which is what the town would be headed for without Colstrip, in her opinion.



ROBERT THIESEN

Robert Thiesen, 50, president of the First State Bank of Forsyth, commented, "There is no doubt that the activity down here has helped the town and stimulated the economy."

Later he remarked, "We have built more new homes in this town in the past three years than, I would say, in the previous 20 years."

Thiesen believes the population of Forsyth has risen to around 2,200 from the 1970 census figure of 1,800.

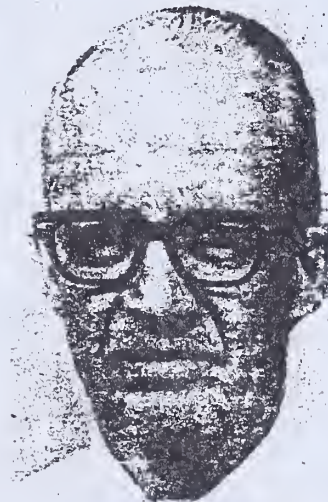
Besides people employed in mining and construction at Colstrip, Thiesen cited increased business for the Burlington Northern and continuing construction of Interstate Highway 94 in and around the town as having beneficial effects on Forsyth. The town is on a main line of the BN and the Colstrip spur line connects with it a short distance west of Forsyth.

THE BANKER said that in his business, mobile-home loans as well as checking accounts are increasing.

Thiesen said of the Colstrip power plant:

"I view it with mixed feelings because I can see both sides ... The plant under construction now should be built, but before any additional ones are built we should see that they are abiding by pollution controls and whether any additional controls are needed."

It can be said that comments by Forsyth's business leaders reflect their vested interests in the Colstrip development. A reporter, however, heard similar remarks in casual talks with waitresses, motel clerks, gas station attendants and bartenders and their assorted patrons.



JACK CLIFFORD

Faith in the future of Forsyth is exemplified by the plans of Jack Clifford, 62, owner and

operator of Jack's IGA on Main Street. Clifford intends to open a new supermarket in July across the street from the building he has occupied since 1951. The new store will be three times the size of the old one.

THE GROCER is a past president of the Chamber of Commerce, is chairman of the board of the Rosebud Community Hospital and Nursing Home, and is chairman of the Montana Board of Trade, which operates under the State Department of Business Regulation.

He also was the first president of the Tongue River-Yellowstone Action Council (TRYAC) when it was formed five years ago. Clifford said TRYAC promotes resource development in Rosebud and Treasure counties, adding that "the human resource is the basic one."

His comments on coal included: "What the hell good is a natural resource if we don't use it?"

Clifford feels that Montana owes the rest of the country something for the long use of its resources.

"Now comes our turn to share," he said.

However, he wants orderly use of Montana's coal.

"**WE SHOULD** get together," he said. "We should have proper laws. We should try to keep the land from being destroyed and the water from being used up."

Clifford said the power plant going up at Colstrip is "great." He added, "But there again, all these controls should be in there in the first place."

If one power plant is "great," what would he think of a string of 10 to 20 plants between Colstrip and Casper, Wyo.?

"I'm real strong on planning ahead — good sound thinking, and good laws for the benefit of everybody," Clifford replied.

He remarked that Montana Power's president, George O'Connor, is a friend of his. They met more than 30 years ago, Clifford said, when O'Connor was a grocer in Fromberg and both men dealt with the old Independent Wholesale Grocers in Billings.

operators are the Consolidation Coal Co. and Westmoreland Resources.

Westmoreland reportedly has contracts with four mid-western utilities for the sale of 76.5 million tons of coal during the next 20 years. It apparently will come from the Sarpy Creek area where the company plans to open a mine next year.

The company currently holds leases on 53,000 acres of private, Indian and state land.

Consolidation, which began its Montana operations six years ago, reportedly has spent \$3 million for lease rights to coal and land. It holds an estimated one billion tons of coal reserves and has leased an estimated 58,600 acres.

Among the other companies prominently evaluating the coal situation are Gulf Mineral Resources, Amax Coal Co., Shell Oil Co. and Chevron Oil Co.

(Next: The public relations of reclamation.)

END

Reclamation takes a selling job

By GARY LANGLEY
Gazette State Bureau

COLSTRIP — Reclamation prompts the glossiest of glossy public relations.

In the field, tour guides and mine officials point to acres of freshly seeded grass and nicely shaped hills that have been smoothed over from the gaping holes created by strip mining.

Public relations departments have written pages of position statements and brochures boasting of successful reclamation attempts.

Here, at Colstrip, the examples of these practices abound.

At the Western Energy mine, part of the tour is a trip through the old spoil banks created by

the Northern Pacific mine where 1,000 acres of land was ripped open and 42 million tons of coal extracted between 1923 and 1958.

About 600 acres are in various stages of reclamation, and the tour guide here points proudly to three-foot-high stands of sweet clover.

OTHER SPOIL banks, where reclamation has not yet begun, look like magnified furrows of a plowed field. On some, grass has begun growing and Mike Hayworth, the tour guide, calls it "natural reclamation."

Since the Western Energy mine began operations in 1969, about 300 acres have been disturbed. Of that, 120 have been

reclaimed with varying degrees of success.

"Before they even turned an inch of topsoil, they signed a reclamation contract with Montana State University," Hayworth boasts.

Thus far, reclamation has been an experiment to test how best to contour the spoil banks as well as to determine the best planting and fertilizing techniques and what kinds of plants grow best.

Hayworth pointed to an area where eight trees were planted and only three survived.

"IF EVERYTHING worked perfectly, then there would be no need for research," he declared.

He also pointed to a 40-acre plot he said was being used as an experimental area by the Environmental Protection Agency "to see what would happen if you don't do anything with it."

Third in a series

Grass is growing, but it is not as lush as in some of the company's more successful reclamation plots. One such area, planted just last spring, shows a thick, lush growth of green grass.

"Reclamation is giving it a cover better than what was here before," Hayworth said.

At the Big Sky mine operated

by the Peabody Coal Co. just south of here, Mine Supt. Al Caskey pointed to a freshly seeded plot of ground and said: "You couldn't tell the difference once we get the trees on it."

RECLAMATION AT both mines begins once a particular area is no longer used for mining. That means after the coal has been removed and roads built along the network of spoil banks to haul the coal are no longer needed.

Topsoil, removed when the huge draglines strip the overburden from the beds of coal, is stockpiled until the land is ready to be reclaimed.

Reclamation

FROM PAGE 1

"You keep filling it in all the time," Caskey said. "It's like plowing a furrow. You remove the dirt; then you put the dirt back where you removed the coal."

Afterward, the landscape is contoured to make it look as if it hasn't been touched. In fact, some mining officials contend it looks smoother and more aesthetically pleasing than the original.

At the Big Sky Mine, it has been something less than successful, however. The growth is thinner than at Western Energy's test plots or Burlington Northern's show cases.

ENVIRONMENTALISTS charge that Peabody, with a questionable environmental record at its strip mines in Kentucky, is unconcerned.

"To a person who doesn't understand the complete problem I'll have to agree," said Al Grandt, St. Louis, who heads the firm's reclamation program.

Peabody has reclaimed about 30 acres in the past 2½ years. Grandt says the effort has been

primarily experimental. Aside from grass, more than 3,000 trees have been planted with 85 per cent success.

"This is strictly good scientific research," Grandt said. "We're not ashamed of reseeding."

He said Peabody's biggest problem was moisture. "To the casual observer it still looks bad," he admitted.

Grandt, who was interviewed in Helena recently, said it takes three years for reclaimed land to become good media for plant growth, and contended the controversy over his company's reclamation at the Big Sky Mine boils down to a conflict in philosophy between "instant growth versus permanent vegetation."

WHEN PEABODY'S reclamation is complete, he said, former rangeland will be restored to rangeland.

Although he did not say how much the reclamation has cost the company, he said, "We're pushing it too hard for real good economical methods. To show people we were going to live with the regulations, we did some work that we shouldn't have done from an economic standpoint."

Reclamation costs vary. An independent estimate from one source closely connected with reclamation indicated that the Peabody effort has cost between \$4,000 and \$6,500 an acre.

At the other end of the scale, Burlington Northern claims to be spending \$600 an acre, and reports its total expenditures to date at \$390,000. Western Energy has indicated that its reclamation costs would amount to \$700 an acre.

AT THE DECKER MINE, reclamation does not appear to have gone beyond the research stage. Several small test plots have been graded and seeded with various species of grass, trees and shrubs.

"We'll have a chance for that to grow and mature and see what we can do with it," Frank Kinney, land and reclamation engineer for the mine, said.

Decker appears to have gone a step beyond the reclamation of other companies. Its effort began in the fall of 1972, when the company launched a research program in cooperation with the U.S. Forest Service. Federal scientists in the program are working with the company to establish vegetation on the spoil banks and disposal piles based on sound ecological principles.

EVEN OPPONENTS of strip mining in this area admit that the coal companies, nudged by a strong reclamation law enacted earlier this year, appear to be committed to sound reclamation practices.

Some of them, however, question the motives.

"They aren't reclaiming it because they want to make something out of it," one eastern Montanan complained. "They just want to do it because it sounds good."

Meanwhile, optimism remains guarded on the regulatory front.

"Until they put on the black hats, they're wearing the white ones," one state official stated cautiously.

(Next: Other environmental concerns)

Mining firm tests reclamation plans

By HELEN M. PETERSON
Editor, Hardin Tribune Herald

HARDIN — Only one coal mining operation in southeastern Montana is involved in an all-out effort to reclaim the land stripped by its big shovels.

Other companies have reclamation plans, too. Not all have had time to put them in operation.

Center of tours for environmentalists, people interested in strip mining, legislators, Indians who may see mining begin on their reservations and others, is the Colstrip area.

Here Western Energy, wholly owned subsidiary of Montana Power Co., has a show place — one spoil bank extending over several acres which has been levelled to a gentle slope, has had topsoil replaced, and then been fertilized and planted. It was even irrigated early this summer — but rains later in the summer made it unnecessary to bring in the sprinklers then.

Annuals — rye and sudan grass — made a lush growth on the slopes. They won't be there next year — but they'll furnish humus, and as a "nurse crop" they protect native plants between the rows. Small trees have been planted along the slopes. Some seem to have a good chance for survival. Others didn't make it. On the hilltop, three 30-foot ponderosa pines were transplanted. They're like

a Christmas tree in January — green, but with no indications of growth.

EROSION IS MINIMAL on this particular plot — but it can be seen elsewhere in the Western Energy effort. Where there is no cover crop, washing is more apparent.

Richard Hodder of Montana State University is directing Western Energy reclamation. He's trying a variety of techniques and plantings. There is actually wheat on one of the levelled spoil banks. Bulldozers have dug basins in hilltops and sides to hold water, which seeps gradually through the spoil material to nourish plants lower on the slopes.

Aim is not to get the land perfectly level. The idea is to have slopes of about the same degree found in undisturbed land nearby. Another objective is to see native plants reestablished some day — but meanwhile to get vegetation.

Burlington Northern is doing a reclamation job at Colstrip, too. Spoil banks are being rearranged with bulldozers, with slopes similar to those created by Western Energy.

BN HAS NO TOPSOIL, and is attempting to create some. Hay is being hauled to Colstrip by the carload. It is scattered over the levelled spoil banks and disced into the gray, slaty material

that covers them. Fertilizing and planting follow. BN is trying a variety of plants. Some of the saplings set out this spring have at least survived the summer. Six varieties were planted. Among the survivors were Chinese elm, locust, Russian olive and poplar.

Currently, most strip mining reclamation plans call for stockpiling topsoil and putting it back. This is creating a debate. Is topsoil all that important? Can an artificial topsoil be created?

Authorities say topsoil is important for two reasons. First it contains the seeds of native plants — and this is the best way to get vegetation back the way it was. Second, it contains soil organisms essential to healthy plants.

Certainly a growing medium can be created. Given enough time, it may become topsoil. This process is less expensive and much less time-consuming than saving the real thing and putting it back on top.

NEXT DOOR to Western Energy and Burlington Northern, Peabody Coal Co. operates its Big Sky mine. Peabody has been in trouble with the state of Montana recently for allegedly not following a reclamation plan filed with the Department of Lands. The plan promised stockpiling and restoring of topsoil. State officials couldn't find any

evidence that this was being done.

Peabody is bulldozing down its spoil banks — but slopes look steeper than they do at Western Energy. Some planting has been done but to a casual observer, it didn't look good.

Decker Coal Co. has a couple of small, experimental hillocks of spoil material which were planted this spring. So far, results are "disappointing," but full scale reclamation won't begin until more coal is removed.

Decker has promised to stockpile and use topsoil. Westmoreland Resources will make this same pledge in its reclamation plan, according to Ralph Moore, who will be in charge of mining operations at Westmoreland's Sarpy Creek mine.

Both companies plan a cyclic restoration of disturbed acres. After two or three cuts are made, the cavities will be filled with the spoil material as mining continues — and then reclamation will begin. Moore says Westmoreland will have 250 acres at most disturbed at any one time.

The Bureau of Reclamation says only about 3 per cent of the Ft. Union coal field will be strip mined, so why the emphasis on reclamation?

EVEN WITH THIS small percentage, the area disturbed would be more than half the size of Rhode Island. Unsightly

scars, long a blot on the landscape at Colstrip, can often be seen for miles.

Reclamation is expensive. Burlington Northern officials estimate their reclamation costs at between \$750 and \$1,000 an acre, and Western Energy is spending more than \$600 an acre. That's much more than the land would sell for. Most of the land to be stripped is grazing land.

The land varies in productivity according to location, and according to the season. It has other values, however. It has been described as a "sagebrush desert." Residents and visitors alike would deny the accuracy of that evaluation.

Coal in southeastern Montana lies under rolling, grassy hills, or steeper, pine-clad ranges. Sometimes it is under creek bottoms. Little if any lies beneath irrigated farm lands.

Cattle production is going to be disturbed. There's the problem of surface ownership vs. mineral rights. On Sarpy Creek, Crow Indians own the coal and non-Indian ranchers own the surface. In other parts of southeastern Montana, mineral rights were reserved by the federal government when the homesteaders moved in. In some areas, the Northern Pacific was the original owner of the land, and the railroad reserved mineral rights when it sold.

UNDER MONTANA LAW, it is possible that the owner of the mineral rights could move the surface owner out. So far, coal mining enterprises have tried to buy the surface to avoid conflict. The legalities of the situation have never been tested in court. Many ranchers, especially those whose parents and grandparents before them began the ranching operation, are reluctant to sell.

It's not just an attachment to the land. In many instances, the coal miners want only part of it. But ranchers feel that economic units would be broken up. As one man put it — "You can't run cattle beside a coal mine." Those who have had ranches split by highway construction have had a taste of what strip mining could mean. Underpasses for livestock can be constructed beneath a highway — so cattle can get from good grass on one side to water on the other — but you can't go under a coal mine.

Ranchers feel that the beef industry would be affected by mining far more than the actual acres stripped would indicate — but if land is properly reclaimed, there is hope for the future.

Then there's the matter of wild life. Southeastern Montana has lots of game. Mule deer and white tails are abundant. Antelope, especially sleek after a summer of good grass, were seen on a recent coal tour. Sev-

eral varieties of grouse are found all over the area — and one of the best breeding areas for wild turkey in the state is right above a coal seam.

MINING MIGHT DISTURB wildlife temporarily, but again, if there is proper reclamation, it ought to return.

Who can tell the results of leaving spoil banks unreclaimed in the region? Dead streams, polluted by acid and other toxic materials washed from spoil banks, resulted in West Virginia and Kentucky. Because rainfall is scanty, some predict that won't happen in the Fort Union area — but who can be sure?

Reclamation is still experimental in the arid west, though some good results have been obtained in North Dakota. It ought to be possible, but it may take a long time.

Advocates of the best possible reclamation point out that present surface value of the land should not be the criterion. They point to the value of the coal taken from below that surface — sometimes many times a million dollars an acre. The cost of reclamation, they say, should relate to the value of the coal — not the present market price of the land.

Besides, they point out, who is to say how much this land may produce—or how much it may be worth, 50 or 100 years from now.



Coal firms don't like him

BY DUANE W. BOWLER
Editor, *The Gazette*

The man the coal company lobbyists call the Honorary Governor of Wyoming is on the job full time these days as lieutenant governor of Montana.

It's Bill Christiansen of Hardin, who succeeded in raising Montana's tax on coal in the 1971 Legislature and wants to make it still higher this time.

The Hardin car dealer got his Wyoming nickname through that ploy used by extraction industry lobbyists. You know the deal. It goes like this, "If you raise the tax on coal in Montana you'll drive all the industry to Wyoming where they don't tax it so high."

LET IT SUFFICE to say that through the efforts of Christiansen and others and over the objections and machinations of the coal companies, Montana did raise its coal tax and the scramble to develop Montana's rich coal fields does not seem to have diminished.

Christiansen wants Montana to raise the coal tax some more, a lot more, this legislative session and to see "the strongest reclamation law in the U.S." become Montana law.

This doesn't make him No. 1 on the coal company list of most appreciated Montanans.

Christiansen shares the belief of a great many Montanans that Montana coal is being sold short, at too low a price. He reasons, and knowledgeably so as his foes in the capitol corridors have found out, that based on its thermal output qualities that Montana coal is worth \$3.50 per ton at the mine-mouth loader.

HE HASN'T PICKED the figure out of the blue Big Sky. It is based on the low sulphur and low ash content plus the heat it will give off.

Based on the BTUs, he figures the direct tax should be 40c to 50c a ton, not the 4c to 11c it now brings. And it is still a bargain at the higher price.

Note Christiansen says "direct" tax of 40c to 50c a ton. This would not account for all the tax income to Montana and its political subdivisions.

He figures the NOW tax situation brings in about 20c a ton in the aggregate. It comes from the license tax, net proceeds tax, person-

al property tax, real property tax and corporate license tax.

This is considered quite unrealistic when compared to the nearly double that amount the united Mine Workers get from firms with which they have contracts.

CHRISTIANSSEN SHARES a growing belief that the costs of reclaiming the land disrupted by strip mining should not be credited against taxes paid. It is a cost of doing business and belongs on the price of the product, not a reduction in the state and county tax income.

Who will pay for it? The ultimate user, the energy consumer in higher rates for the product. That's who is supposed to pay for costs involved. Taxes are part of costs.

For those who would say this will throw a huge burden on the Montana consumer, Christiansen points to where the coal is going. Right now, he figures, 80 per cent of the Eastern Montana stripped coal is going out of the state. That figure may well go to 90 per cent as the industry expands.

Operation of mine-mouth electrical generating plants and coal gasification plants will serve only to increase the export of the coal resource—even if it is in another form.

An irreplaceable Montana resource is being depleted and the state of Montana and its political subdivisions are getting pitifully little by comparison.

CHRISTIANSSEN EXPECTS the coal industry to protest any increase in taxes, reclamation credit and stricter laws. He expects to hear the same old, time-worn threats of "industry leaving the state" if taxes are increased.

He recalls the threats of two years ago when he engineered the present tax law into the books. He's also watched the coal output increase from one million to 7 million tons a year.

It is his opinion, that of a reasonable man interested in the future well-being and economy of Montana, that the coal industry should be paying a lot more in taxes.

If they don't, Montana will be getting short-changed as its resource goes up in smoke and rattles away on the rails to feed the energy needs of far-away places.

Demand Is Up Sharply For Low-Sulphur Coal

Continued from Page 15

"certainly be competitive with other types of power."

Meanwhile, more than three million tons of coal will be mined this year in southern Wyoming around Hanna by three companies — Rosebud coal sales, owned by the Peter Kiewit Sons' Co., Arch Mineral Corp. and Energy Development Corp., the U.P. spokesman said.

This compares to 1.5 million tons in 1971. Some of the coal fields are owned by U.P. and others by the federal government, the spokesman said. There are an estimated 4 billion tons of coal reserves around Hanna, he said.

Another 480,000 tons will be mined at a new operation on U.P. land in western Wyoming near Reliance by the Rocky Mountain Energy Co., a U.P. subsidiary, the spokesman said.

9 Trains

There are now nine U.P. coal trains of 90 to 100 cars leaving Wyoming on regular runs each week. Four of the trains have been added this year, the spokesman said.

There are 38 weekly coal trains of between 70 and 100 cars being operated this year by Burlington Northern, from mines worked by the Western Energy Co., the Consolidated Coal Co. and the Peabody Coal Co. on railroad lands in south-central Montana and northwestern North Dakota, a spokesman said.

This is four more trains weekly than last year and compares to only eight trains a week in 1968, he added. There are 62 billion tons of coal resources in Montana and North Dakota, he said.

Burlington Northern has no low-sulphur customers in the Omaha area, sending its coal to points in Minnesota and Illinois. U.P., however, delivers coal to

the Omaha Public Power District and the Iowa Power & Light Co. in Council Bluffs.

Spokesmen for the power companies said their firms turned to the low-sulphur coal to cut down on plant pollution and because supplies of the higher-sulphur coals were dwindling.

OPPD

OPPD began using the coal from Wyoming late in 1969 and this year has contracted to receive 600,000 tons, a spokesman said. The district has also ordered 300,000 tons of coal from Kansas.

The Wyoming coal has a sulphur content of 1 per cent or less while the Kansas coal, which has a higher heat intensity when burned, has a sulphur rating of 3 to 3½ per cent, the spokesman said.

Iowa Power & Light, which first ordered a test batch of the coal in 1969, will receive 300,000 tons of it this year, representing the total supply the plant will use, John Thorson, Superintendent of the generating station, said. Before that the plant also had burned coal with a higher sulphur rating from Oklahoma and Missouri, he said.

The Fremont, Neb., Department of Utilities has ordered a 1,500-ton trial shipment of Wyoming coal and will probably order another 10,000 tons, William Sommers, general manager of the department, said.

The Fremont department still has "quite a bit" of higher-sulphur Kansas coal on hand which it will be using also, Sommers added.

The largest nearby user of the Wyoming coal is Iowa Public Service Co. of Sioux City, which will use 1.1 million tons this year, Stan Swanson, assistant to the president, said. The power company began using the coal two years ago, he added.

Pollution Concern Spurs 'Coal Rush'

By Roger Lewis

During the late 1950s and early '60s mining of low-sulphur, clean-burning coal in Wyoming, Montana and North Dakota was nearly at a standstill.

This year millions of tons of the coal, formerly used to power steam locomotives, will be removed from new and reactivated mines to be used mainly by power plants in producing electricity.

A low-sulphur "coal rush" was spurred a few years ago by concern over the emission of sulphur dioxide, a potentially dangerous air pollutant, from power plant smokestacks.

Now it appears the demand for low-sulphur coal will be significantly increased as the gas industry turns to manufacturing "coal gas" to supplement dwindling natural gas supplies, say spokesmen for the Union Pacific and Burlington Northern Railroads, principal transporters of the coal.

Currently there are no "gasification plants" operating in the United States, although there are plants operating in Great Britain, Germany and South Africa, said Ernest Thurlow, assistant vice president of minerals and lands for Burlington Northern.

Technology

He said coal gas still doesn't burn with the same intensity as natural gas, but the necessary

technology is expected to be developed in the near future.

Current plans call for two gasification plants to be in operation in New Mexico by 1975 and there are proposals for other plants in Illinois, Indiana, Montana and North Dakota, Thurlow said.

H. M. Sampson, vice president of corporate development for Northern Natural Gas Co., said such a facility is "definitely in the cards" for Northern.

The Omaha-based firm has been working on coal gasification plans for two years and is negotiating with companies mining low-sulphur coal to obtain long-range contracts for a

billion tons of coal, Sampson said.

He said Northern is trying to develop a venture with three or four other companies for construction of a \$1-billion plant capable of producing a billion cubic feet of coal gas a day. Sampson declined to name the other companies.

14 Years

He said such a plant, either in Wyoming or Montana, would consume 80,000 tons of coal a day when operating at capacity. Completion of such a plant is eight to 10 years away, the vice president said.



Low-sulphur coal mining in Hanna . . . Volume doubling this year.

The billion tons of coal would be equivalent to 10 trillion cubic feet of natural gas reserves. Northern currently has reserves of 13 trillion cubic feet.

At current use levels Northern's natural gas reserves will last 14 or 15 years, he said. The coal gas reserves, supplemented by natural gas, would last about 25 years and Northern would probably add to its coal supply as years went by, said Sampson.

While coal gas prices will be higher than natural gas, Sampson said the cost would

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Million acres of coal marked

By GARY LANGLEY
Gazette State Bureau

HELENA — A list of figures, reportedly taken from official documents, was compiled Thursday showing that more than a million acres of land in eastern Montana has been earmarked for strip mining.

The figures were compiled by the Billings-based Northern Plains Resources Council, a group of ranchers and young people opposed to strip mining, and delivered to Helena Thursday — the day before a measure calling for a moratorium on coal development is scheduled to come off the table in the Montana House.

In addition to land earmarked for development, the figures also show applications for leases on another 427,000 acres — which together total about 1.5 million acres or 2,400 square miles.

A BREAKDOWN includes nearly 600,000 acres already under lease; 496,000 acres under prospecting permits and the 427,000 acres on which applications have been filed.

Private land under lease totals more than 329,000 acres, according to the council's figures along with more than 36,000 acres of Bureau of Land Management (BLM) property, almost 57,000 acres belonging to the state

and 77,000 acres owned by the Crow and Cheyenne Indian tribes.

Most of the land under prospecting permits, which means strip mining firms have been given permission to prospect for coal, belongs to the Crows and Cheyennes. Of that total, 37,500 acres is BLM land and the rest is owned by the Indian tribes.

Of the land on which applications have been filed, 7,000 acres belongs to the state, and the rest is BLM land.

THE COUNTIES in which private land has been leased included in the list are Big Horn, Custer, Dawson, Fallon, Musselshell, Powder River, Prairie, Richland, Rosebud, Roosevelt, Treasure and Wibaux.

Kit Muller, executive secretary of the council, which has a mailing list of 3,000 persons, said the figures were taken from state documents, individual leases, memorandums of leases, abstracts and options to lease inspected in individual county courthouses by the organization's eight-member staff.

"The people who have done this have looked at literally thousands of leases in the last three weeks," he said. "We're sure they're (the figures) are correct."

MULLER SAID he plans to give the list to various state agencies involved in coal development.

"People in Montana have a right to know what's going on in this state," he said.

Muller described the list as a "first compilation" and a more complete one naming those who have leased the land and specific areas will be ready later along with a map.

"The last time I counted, there were 87 companies leasing coal in Montana and Wyoming," he said.

The list was delivered to Helena Thursday afternoon by Mr. and Mrs. Boyd Charter, Billings area ranchers who are opposed to coal development and favor a moratorium.

"THE REASON IT ties into this moratorium thing is I don't think people realize the number of coal companies involved," Mrs. Charter said, expressing concern about a "gold rush" type of development in eastern Montana.

The Charters, who own a 45,000-acre ranch north of Billings, said they had been asked to lease coal land but declined.

Meanwhile, the fate of the moratorium bill — HB 492 which has been on the table in the Montana House since Feb. 19 — is uncertain.

Rep. Dorothy Bradley, D-Bozeman, sponsor of the bill, said she hopes for action Friday that will hold the measure over until next year's session of the legislature.

She said the moratorium probably would not pass the House if a vote is taken Friday.

Gazette

SECTION TWO

Bob Wiedrich

Tower Ticker



DECKER, Mont.—If ever the glorious day arrives that Chicago's atmosphere has lost its sickly licorice cast, a small patch of Montana landscape and a relative handful of men will have played a role in achieving that happy event.

For out here, seemingly in the middle of nowhere, giant machines are reaping a harvest of low-sulphur-content coal for the electric-generating plants of the Commonwealth Edison Co. nearly 1,500 miles away—coal to help the Windy City fathers fight the pollution that threatens to strangle the lifestyle of this nation.

When Chicago's stringent ban on burning coal containing more than 1 per cent sulphur was imposed last Sept. 1, Burlington Northern Railroad unit trains were already rolling at a rate of five a week from the Decker Coal Co. surface mine to Illinois, each hauling 10,000 tons of low-pollutant coal in 100 hopper cars.

A Surge in Business

Early next year, the number of trains will have been increased to eight a week and by May 1, the Decker mine will be shipping coal to Chicago at a rate of four million tons a year, all of it to the Edison Co.

The beauty of this shimmering Montana coal is more than surface deep.

Its true value lies in its low sulphur content, usually about .5 per cent. And that means the black diamonds from the far West can be mixed with Illinois coal and still conform with standards of the new Chicago anti-pollution law.

For the most part, however, Commonwealth Edison uses the Montana coal straight in its two coal-burning, generating plants in Chicago, plus one at Lockport in nearby Will County. In the next decade, the utility has contracted to buy some 40 million tons of western coal.

Witnessing the Decker Coal Co. mining operation for the first time comes somewhat as a shock, as it suddenly rears from the Rosebud Valley floor some 20 miles north of Sheridan, Wyo., just across the Montana state line.

At first, its towering storage silos and grotesque machinery resemble more some man-made experimental station on a bleak, snow-touched moonscape, from a distance silent and uninhabited.

Then suddenly you are upon it, and the sheer size of it is awesome in a

desolate land where deer can be seen on distant ridges and coyotes scurry in the gullies that pockmark the terrain.

You drive up a dirt road with the snow-capped Big Horn Mountains over your shoulder, ascending a hill overlooking the 1,680-acre mining tract.

Below, the earth has been laid open to a depth of 80 feet to expose the 52-foot-deep seam of subbituminous coal which is being scooped up by a 16-cubic-yard shovel and loaded into 70-ton trucks before being crushed into two-inch diameter chunks for storage in two 13,000-ton-capacity silos.

But the real monster of this modern mining operation is an 1,850-ton crane, what the industry calls a dragline, a \$4-million piece of equipment manufactured by Bucyrus Erie which took nine months to assemble on site.

Its cab stands 80 feet tall, it measures 72 feet across, and the bucket dangling from its 285-foot boom gouges 61½ tons of earth and rock from atop the coal seam every few minutes, 24 hours a day, seven days a week. Because of the 7,200 volts of electricity used to power it, the dragline is virtually silent.

Descend into the mine and stand beside this towering behemoth as it momentarily rests. And when its giant arm resumes its silent swing, you suddenly know how man felt when he saw his first dinosaur.

Final Leg of Journey

Across this vast land now sounds the blast of a diesel horn and the rumble of an approaching Burlington Northern train with its load of 100 empties returning from Havana, Ill., near Peoria, where western coal is transhipped to barges for the final leg of its journey to Chicago generating plants.

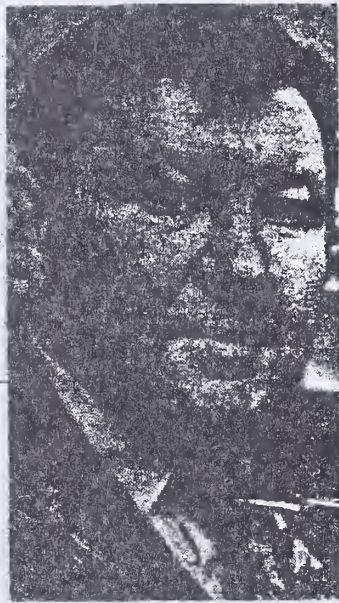
Within two hours and without ever stopping, the train will be loaded with 10,000 tons of coal by just two men handling the controls of a 120-foot-high tippie. The train will creep continuously beneath a loading chute at a precisely calculated .4 in. p. h.

Then the engineer will crack open the throttle controlling seven locomotives, and another load of low-pollutant coal will be enroute to help clean the Chicago skies, hopefully as clear some day as those that embrace the peaks of the Big Horn Mountains of the far West.

Coal is inviting invasion



OLSON



HENNING

By MICHAEL C. OLSON
and
DANIEL H. HENNING, PH.D.

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Introduction

It is sad and tragic when something beautiful and relatively unspoiled as the environmental quality of Montana as well as its way of life becomes a West Virginia or California. Yet the crushing pressures of coal strip mining and power plant corporations definitely point this direction on an invasion basis.

And this invasion literally points toward the economic and political colonization of Montana as a remaining frontier to be conquered, exploited, and ruined, i.e., to take Montana out of Montana.

Although much of this invasion centers around the rich and strippable coal deposits which underlie about one third of

the state, there is also the important factor that the state's legislation and government are not prepared to handle or control this invasion at this time, despite growing public concern (although some "Montanans" are for economic development at any cost).

Further, massive public relations and/or brain-washing programs by corporations are now underway to reduce opposition to the invasion and its negative influences.

THE COAL STRIP MINING situation in Montana has literally taken everyone by surprise. Until recently the majority of Montanans viewed strip mining as an industry confined to the eastern states, particularly West Virginia. Through various media, strip mining has been presented as a method of removing coal by destroying surrounding environmental quality permanently. Montana and its inhabitants are now faced with the likely possibility that Peabody Coal Co., Consolidation Coal Co., and a host of other strip mining organizations are here to stay.

The quality and tremendous amount of coal in Montana are two of the major reasons for the present deluge of coal companies. The Fort Union coal reserve has been estimated at 1.3 trillion tons, with strippable reserves in Montana approximating more than 30 billion tons. The chemical properties are excellent; it is low in ash, sodium and sulphur.

In the age of the supposed "energy crisis", or increased demand for electricity, Montana coal is also tempting because of the low cost of shipping and convenience of water supplies. The state's vast reserve can be used to supply electric power generators, petroleum products, or many other hydrocarbon derivatives.

The effects of strip mining, however, present numerous social, economic, and environmental problems to the people of Montana. Some of the areas of concern are:

Water

Coal associated developments demand a tremendous amount of water for cooling and conversion. The possible use of ground water has not yet been fully researched; but the Montana Bureau of Mines and Geology indicates that the ground water resources are not satisfactory to supply the impending industrial development. (1)

If true, use of the surface water sources would be necessary. In the Montana Fort Union area, the Powder, Bighorn, Tongue, Yellowstone, Missouri, and Little Bighorn rivers would have to be utilized. The energy companies would require a flow control obtained through the use of dams and reservoirs.

At present, Montana does not have adequate storage facilities to accommodate water supplies of this nature. This would not only mean more dams, but interbasin and interstate transportation of water through a complex network of pipelines proposed by the Bureau of Reclamation. (2)

FIRST CALLS FOR industrial delivery of water are set for 1980. Projected use requirements are for a full third of the average annual flow of the Yellowstone River. (3) In dry years, the Yellowstone River discharge is approximately cut in half. One can only assume that the water needs of energy companies will not decrease at such a time. Furthermore, large quantities of Montana water will be exported, leaving a possible local depletion.

Accordingly, a complete development of Montana water resources would be required. In this sense one can only expect a drastic change in the river ecosystems, rural life-styles, and agricultural ranching patterns in southeastern Montana

Reclamation

The Montana Bureau of Mines and Geology indicates that 1973 coal production in the state will be about 16 million tons and that it will be expanded to more than 20 million tons annually by 1975. (4, 5)

At present, 275 to 520 acres of land are overturned yearly by strip mining companies. The semi-arid condition of Montana hampers reclamation efforts considerably, particularly with low rainfall, short growing season, and poor soil. According to the Southwest Energy Study, revegetation of strip mined areas in arid regions has rarely, if ever, been successful.

On the assumption that reclamation would be effective, there would still be considerable delay before the land could be returned to its full production. It is doubtful that the ecosystems would revert exactly as they were; thus negative effects on wildlife, plantlife, and environmental quality would be obvious on short and long range terms.

PREVIOUS RECLAMATION attempts in the eastern states can only be described as disastrous. According to an official in the Montana Land Reclamation Division, "The only things growing on Peabody land are weeds."

Montana presently has four major coal mining operations: (a) the Knife River Coal Mining Co. (mining west of Savage), (b) Peabody Coal Co., (c) the Western Energy Co. (mining at Colstrip), and (d) Decker Coal Co. (mining at Decker).

Under the terms of 1967 legislation, coal companies are not required to obtain a reclamation contract, but are encouraged to do so because of tax credits up to half the cost of reclamation. (6)

In addition, no performance bonds are required to see that reclamation called for in the voluntary contracts is actually carried out.

Air pollution

The North Central Power Project (NCP) indicates a profound environmental impact from air pollution. The NCP assumes a 9 per cent ash content in the coal, and 85 per cent load factor, and a 99.5 per cent ash removal. A 50,000 MW(e) generating complex will produce 94,500 tons of fly ash per year. However, the apparent average ash content in Montana and Wyoming coal is 15 per cent, and assuming 97.5 per cent ash removal, 787,500 tons of fly ash would be produced in a year. (7) In time, only higher ash coal will be available, and air pollution controls will become less efficient due to overloading and general aging. According to Thomas J. Gill, Research Assistant for the Montana Environmental Quality Council:

Even with the most advanced pollution control equipment, enormous amounts of pollutants would be introduced into the atmosphere as a result of the vast quantity of coal used. Electrostatic precipitators and wet scrubbers can remove 99 plus per cent by weight of the particulate matter but a much smaller percentage of fine material (less than one micron in diameter). Unfortunately, it is the finest that stay suspended longest, enter

most easily and deeply into the lungs, and inhibit visibility. A current example of the problem is the 2,075 megawatt Four Corners plant at Farmington, N.M., which in early 1971 emitted over 465 tons of particulates each day and whose plume of pollution could be traced back to the plant from a distance of 140 miles. The magnitude of the future problem can be foreseen when it is realized that several of the North Central Power Study Plants proposed for Montana are two and a half to five times as large as the Farmington operation. (8)

Sulphur dioxide is also a major pollutant from coal burning operations. President Nixon's February 1971 message to Congress states:

Sulphur oxides are among the most damaging air pollutants. High levels of sulphur oxides have been linked to increased incidence of such diseases as bronchitis and lung cancer. In terms of human health, vegetation, and property, sulphur oxide emissions cost society billions annually. (9)

The environmental quality would also be hampered by the transmission lines needed at mine-mouth generation plants. (10)

Nevertheless, an official of the Air Pollution Control and Industrial Hygiene Department stated Montana's Air Pollution laws were entirely adequate and that, "Montana has nothing to worry about, things are under control." (11)

Population influx

Montana could feasibly gain 300 thousand to 400 thousand people either directly or indirectly as a result of unlimited strip mining. One multi-product complex would employ more than 3,000 people and might create a city as large as 24,000 (1)

This would, of course, benefit small communities with a previous population decline. But the negative results of population increase must also be studied. A definite tax increase could be expected at all levels due to the greater needs and demands of the populace for various governmental services. However, unless land reclamation would be total, the stripped land would have little tax value.

New schools would have to be erected, police and fire protection would spiral, and the sewage systems would have to expand to mention but a few of the developmental problems.

Relative to this, strip mining can increase present population by over 30 per cent. If this estimate proves itself to be accurate, quality environment will assuredly decline and along with it the frontier attitude. It will be replaced with a possible and temporary increase in living standards, an increase in crime, urban sprawl, pollution, and other urban problems.

MONTANA'S UNEMPLOYMENT problem would certainly improve somewhat with the need for manpower that strip mining would require. The question then is how long will the energy companies stay in Montana. The lifetime of proposed generation facilities for Montana coal development is estimated to be about 30 years. (12)

Assuming a conservative increase of 300,000 due to the strip mining situation, what then will happen to those, directly or indirectly, who are financially dependent upon the coal industry? If history should repeat itself, Montana will join the ranks of several Appalachian states, leaving the government little to tax and the people with high unemployment rates.

The problems of population growth must be recognized and studied now for the benefit of not only present but future generations. Yet United States Representative John Melcher (Democrat-Montana) has stated that this predicted population increase is totally "unbelievable" and "highly doubtful." (13) Perhaps Rep. Melcher's attitude is totally "unbelievable." The time for speculation is over, Montana must now have the factual figures to population expectancy in future years.

State officials

"Montana's coal has been discovered," according to former Gov. Forrest H. Anderson, "and this state needs economic stimulus. That coal will be mined." (14)

Anderson feels that Montanans are not willing to give up automobiles, electric lights, and so forth in order to save a "few acres of land." Anderson saw no present solution to the coal strip mining situation; he did indicate the fear of energy depletion, combined with the supposed need of new industry to alleviate the unemployment problem, would probably override the environmentalists.

Anderson was the only individual interviewed that stated he foresaw strip mining in Montana about 10 years ago. He felt that Montana must "utilize the total coal capacity" for the economic benefits it will bring the state and said, "I only hope the people will realize its potential worth so the Easterners will pay enough for it." (15)

FLETCHER E. NEWBY, Executive Director of the Montana Environmental Quality Council, emphasized the fact that the strip mining situation had top priority even before the North Central Power Project was published. Newby presently views Montana law as entirely inadequate relative to selective prohibition of mining sites and stated, "We certainly don't have to mine unreclaimable lands, and yet Consolidation Coal proposes to do so in the Bull Mountains." (16)

Newby shares the same concern Anderson has over the economic benefits that Montana is presently receiving, "Montana isn't getting a whole hell of a lot out of strip mining, in fact we are getting ripped off for somebody else's benefit." (17)

John Goers, administrator for the Reclamation Division of the Department of State Lands states, "It won't be stopped. They (strip mining companies) are too strong, so we have to look for tougher strip mining laws." (18)

When asked about present Montana reclamation, Goers stated, "In this state no land has been reclaimed to the point where grazing can be fully accomplished. Possibly it can be done with land rest." (19)

Goers felt Montanans should look at the other effects of strip mining also and stated, "Reclamation is all you can hear presently, but people should become aware of the effects strip mining will have upon population increase, gasification, power plants, and water consumption to name but a few." (20)

OF THE MANY INDIVIDUALS interviewed, only O. M.

Ueland, Executive Secretary of the Conservation Commission, felt Montana's present laws were adequate to control land reclamation. Ueland indicated that the topography of reclaimed lands would not be the same but that topsoil would be saved and redistributed evenly over disturbed lands. Ueland also indicated that several of the mining companies felt reclaiming the land to any great extent was financially unfair because some of the mined land has little economic value even when fully restored. Reclamation expenditures presented to Ueland were sometimes as low as \$20 per acre. (21)

Contrary to Ueland's overall confidence concerning the control over mining companies, Goers presented a picture of impending crisis unless better state laws are passed. Anderson did not appear to be overly concerned, realizing this problem is not one he will have to contend with. (Gov. Tom Judge was sworn in on January 1.) Fletcher Newby was confident that the strip mining could be adequately controlled by the Montana government and elected officials.

A GREAT MAJORITY of the officials interviewed privately felt strip mining should be banned from the state immediately. They will not, however, state this publicly for various reasons relating to their positions of authority.

The awesome political and economic structure of the energy companies seems to be ever present in the minds of policy makers. As one agency official stated, "It is one thing to oppose a small group of environmentalists consisting of

students, teachers, and housewives; but it's a different story when you take on a number of organizations with billions of dollars at stake." (22)

This predominant fear of big business conflict appears to be condoned by most bureaucrats as a form of job survival or security. This may be fine of them as officials, but it is disastrous for the state.

Montana now more than ever in time needs a strong leadership. The ultimate goal of state bureaucracy must not be the financial betterment of industry at the cost of destroying tradition, life-style, and environmental quality.

The problems of strip mining are overwhelming when considering the social, environmental, and economic consequences facing present and future generations. In this sense, public opinion should be a guideline for the decisions and actions of Montana officials.

YET SEVERAL STATE OFFICIALS indicated that public opinion has little weight, with the exception of those individuals belonging to pressure groups, especially those with connections in Washington, D.C.

The greater percentage of Montanans have neither the time nor the finances to join pressure groups that coincide with their own personal values on environment. This should not, however, lessen their right to political leverage in the eyes of our present policy makers.

According to an official of the U. S. Bureau of Land Management, "We are the experts in land management. We don't have to prove our policies to the public. If the people want change, they more or less have to prove us wrong." (23)

This statement implies that state inhabitants do not realize what is best for themselves and Montana. Perhaps the supposed "experts" should place less emphasis upon their own opinions and industries and pay greater attention to the people of Montana, the people they work for, and the people who will have to live "with it."

Conclusion

There are plenty of ways and alternatives of getting at the "so-called" energy crisis for other states (some authorities have noted that the power needs for Montana could be met by increasing the generators by 75 per cent at Fort Peck Dam) beyond the wasteful coal strip mining and power plant method. Yet this method and invasion will provide high profits to corporations on a short term basis and will bring a complex array of abuses and negative influences to the environmental quality and people of Montana.

Although state government, at present, can be criticized for its lack of resistance to the invasion (and for its lack of real commitment to environmental quality), the federal government (55 per cent of coal deposits in Montana are on federal public lands), through the U. S. Bureau of Land Management, has certainly been quite cooperative in some instances relative to coal strip mining leasing. Further, Indian reservations have leased considerable amounts of their lands to corporations (although there are no legal provisions for reclamation on reservations).

HISTORICALLY, GOVERNMENT'S prime values have centered around the economic, materialistic, and techno-scientific, yet new and unifying values of environmental quality are desperately needed now, particularly to avert and control the coal strip mining and power plant invasion in Montana.

In a recent public address at EMC, Fletcher E. Newby, executive director of the Montana Environmental Quality Council, indicated that he was very pessimistic about the future of environmental quality in Montana. He further indicated that federal help and funds were needed very badly.

Along the same lines, citizen environmental organizations on the national level need to become involved and to supply help. Otherwise, one of the last remaining states with environmental quality will be irreversibly experimented with and ruined.

The people of the nation and state have a right to demand factual proof that the energy companies will not harm Montana environmentally, socially, or economically. If this cannot be done (and there is no definite proof that reclamation will work in Montana at this time or that the numerous power plants will not each be greater polluters than the Four Corners one), then coal strip mining and power plants should be outlawed in the State of Montana.

Yet, on and behind the scenes at present, the invasion and colonization of the State of Montana by energy corporations is now rapidly proceeding in a frightening magnitude with little real resistance.

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Strip mining hot issue

By GARY LANGLEY
Standard State Bureau
(First of a series)

DECKER — This vast rangeland, encompassing nearly the entire southeastern portion of Montana, from its rich cattle country to its historical Indian reservations, isn't the latest of the state's environmental troublespots.

But it is the hottest. The issue is coal.

The area defies description by generalization. It is a combination of rock-capped buttes, badlands and scenic rolling hills dotted with pine trees. In many areas, a dull red dust covers the landscape where coal came to the surface millions of years ago and burst into flames.

Despite its dry climate — the source of bitterly cold weather in the winter when the temperature dips to minus 40 and summer temperatures that soar into the 100s — it is cattle country. More than 200 families depend on its rangeland for a living.

It also is prime wildlife country where the mule deer hunting is considered excellent.

EXCEPT FOR the ranchers, it is almost devoid of people. The towns embody Mark Twain's concept of the "one horse town;" few have populations in three figures, and those in the very heart of this country — with names like Decker, Kirby and Birney — are merely mailing addresses for ranchers.

It sits atop between 30 and 40 million tons of economically strippable coal which, because of its nonpolluting low sulfur content, has become economically important again after nearly two decades of inactivity.

Recent estimates by the Montana Bureau of Mines and Geology indicated six billion tons of it will be mined and 200 square miles of land will be disturbed in the next half century.

Realization of that estimate, considered by some to be conservative, could make this area one of the world's largest coal producers.

Strip mining is nothing new here, and could become a way of life in the future.

It was begun in the early 1920s by the Northern Pacific Railway Co. for locomotive fuel. But with the advent of diesel power, activity decreased until 1958 when the mine closed after producing 42 million tons of coal and disturbing 1,000 acres. Western Energy, a subsidiary of the Montana Power Co., began mining again in 1969.

Western Energy is not the only coal producer in this area.

Three other mines have opened; others are preparing to open, and about 25 major corporations have indicated an interest in eastern Montana's coal reserves to the point of leasing land and mineral rights.

THE NUMBER of companies involved has set off a tug-of-war over leases, mineral and water rights and has sparked dealings that appear shrouded in secrecy, distrust and fierce competition.

The number of acres, private and public, that have been leased is awesome. The Northern Plains Resource Council, a Billings-based landowners' association which conducted a county by county analysis of the situation last spring, estimates 601,000 acres has been leased by coal companies — nearly 1,000 square miles. Up to 60 per cent of the land is owned by the federal government; the rest belongs to the state and private landowners, the largest of which is the Burlington Northern.

Because of a complex situation involving surface ownership and the ownership of mineral rights, the companies have made a number of arrangements with landowners.

In some cases the surface owner is not the mineral owner. In others, the surface owner owns both the surface and minerals.

As a result, coal companies have purchased the surface outright from some landowners while they have leased the surface from others. Or they have purchased or leased the mineral rights.

In some cases, payment is on a royalty per ton; in others it is a flat amount.

If the economics is confusing, it also is kept in the strictest confidence by those involved.

"THERE'S SOME curious arrangements," one man connected with coal development told the Standard State Bureau. "They've done all kinds of things."

Economics aside, coal development appears to be here to stay. The only question remaining is how large it will become.

Bulldozers, gaping open pits and giant draglines have become as common to the observer here as plowed fields and farm vehicles.

Their presence has set rancher against rancher, Indian against Indian, coal producer against environmentalist and even coal company against coal company in the tug-of-war over control of the coal and the environmental consequences its extraction will have on the area.

The foremost concern is strip mining itself. It is an awesome process that involves huge draglines — resembling cranes that are larger than some buildings — that gulp topsoil by the cubic yard. The very landscape — in some cases 150 feet deep — is scooped away, revealing black beds of coal that run from less than 10 to more than 50 feet in depth. In some cases there are two, and even three or more, beds of strippable coal.

"They've got the pendulum swinging their way," one angry rancher said. "Montana thinks it can control this, but it's not going to turn out that way."

Like many other ranchers, his primary concern is the agricultural land he fears will be taken out of production by strip mining.

Environmentalists are outraged by strip mining. They say it will permanently destroy the surface of this area and rip its ecological balance to shreds.

THE MOST VOCAL group is the Northern Plains Resource Council which claims a membership of 4,000 landowners and environmentalists.

The organization is not against extracting eastern Montana's coal, but contends strip mining is the wrong way to do it.

"We would just as soon see it extracted by deep mining," said Kit Muller, executive director of the council. "We feel very strongly that if there is going to be strip mining in the area at all it should be very selective."

Those who favor strip mining counter with dire forecasts of the pending energy shortage if coal is not developed, and say deep mining will recover only half as much coal as strip mining.

Ranchers, who have leased their property to coal companies, are not worried about a sharp drop in agricultural production. They say they can invest the money they receive in coal royalties to improve their ranches.

Burton Brooster, who is 70 years old and has four grandchildren interested in running his ranch, is one of them.

"It's my viewpoint that we can take this coal money and make better ranches for the grandchildren," he intimated.

Beyond those concerns, controversies have erupted over the potential demand for water, air pollution from power plants that will be built in the future to convert the coal to electrical energy, transmission lines, railroads and a booming population for which the area is unprepared.

Each of the concerns will be examined in detail in future installments.

(Next: The Mines and Mining)

Several firms compete for coal fields

(One of a series)
By GARY LANGLEY
Standard State Bureau

COLSTRIP — The race is on for eastern Montana's coal, but exactly how many competitors eventually will be in the running is anybody's guess.

Two large corporations currently are strip mining here: Peabody Coal Co., the world's largest producer of coal which operates the Big Sky Mine just south of here, and Western Energy, a subsidiary of the Montana Power Co., and currently Montana's largest coal producer.

Fifty miles to the south, the Decker Coal Co., a division of the Peter Kiewit Sons' Construction Co., is stripping coal. And in the mid-eastern section of the state, miles from the richest of the coal beds, the Knife River Coal Co., the smallest of Montana's major miners, is stripping away land near Savage.

Since 1969, coal production in Montana has increased by giant leaps.

It was one million tons four years ago, but had jumped to seven million tons by 1971 and is expected to reach 16 million tons by the end of this year. Two years from now, production is expected to reach 20 million tons.

But the biggest jumps are yet to come: Estimates place coal

production in 1980 at 75-80 million tons.

Last year the two strip mines here accounted for about half of the state's coal production.

The biggest is the Rosebud Mine owned by Western Energy which in turn is totally owned by the Montana Power Co., a mammoth private utility that currently is building two 350-megawatt coal fired steam generating plants near the mine site to convert the coal to electricity.

WESTERN ENERGY bought its mine from the Northern Pacific Railway Co., now part of the Burlington Northern conglomeration, in 1959. However, it did not reopen the mine until 1969 on a 3,300-acre, 30-year lease granted by the Northern Pacific at the time of the purchase. For the past two years, the mine has been the third largest bituminous mine in the United States.

According to the firm's figures, it produced about half a million tons during its first year of mining; 1.7 million in 1970; 5.2 million in 1971, and 5.5 million last year. The company boasts that by 1980 the production level will reach between 12 and 13 million tons.

Something the company does not boast about, however, is the lags that are expected during at least the next two years because of a keenly competitive sellers market for the coal.

Gene Tuma, the mine's director of conservation, said the company has a mining permit for 850 acres. The surface is owned by Peabody; the mineral rights by the federal government and the Burlington Northern. However, independent sources indicate the company has leases on another 28,000 acres and could have a hold on more Montana coal than any other company.

At the mine site, a giant 30-cubic-yard dragline gobbles away from 40 to 100 feet of overburden that rests atop the 25-foot seam of Rosebud coal. Another 20-35 feet down lies the smaller McKay seam which is about seven and a half feet deep.

Company officials said they could not locate figures to indicate the firm's investment, but were quick to cite what they describe as "economic input." The mine employs 52 persons with an "economic input" of well over \$1 million in payroll, taxes and goods and services, James W. Whitney, director of public relations, said.

The life of this economic windfall is expected to be 30 years.

The newest of the three large miners is the Decker Coal Co., a division of Peter Kiewit Sons' Construction Co. in partnership with Pacific Power and Light.

The mine opened in 1972 and produced 700,000 tons of coal by the end of the year. It expects to mine four million tons of coal by the end of 1974, and eventually reach a production level of six million tons annually.

FRANK KINNEY, land and reclamation engineer at the mine, said about 55 acres of land is disturbed a year. In 20 years — the expected life of the mine — about 1,500 acres will be disturbed, he added.

Although the Kiewit-PP&L partnership is 50-50, the construction company manages the mine. The utility's plans, if they include construction of a power plant at the site, remain unannounced. However, there is speculation the company intends to build one.

Although the mine is relatively small, it employs 90 men and its mammoth 41-cubic-yard dragline is uncovering a solid 52-foot-deep bed of coal in an operation that represents a \$24 million investment.

The two companies involved in the mine have leases on an estimated 19,800 acres of additional land.

The only other company of consequence currently extracting coal from eastern Montana is the Knife River Coal Co., a subsidiary of the Montana-Dakota Utilities Co., at Savage. It produces about 300,000 tons of coal annually for MDU's power plant at Sidney.

Most of Montana's coal is shipped to the Midwest.

The Decker Co. has contracts with Commonwealth Edison of Chicago. Most of Peabody's coal is shipped to the Minnesota Power and Light Co., while Western Energy supplies several clients in the Midwest in addition to a Montana Power Co. power plant at Billings. It is expected to provide the MPC

power plants at Colstrip with three million tons a year once they are completed.

The coal is exported by rail at an astounding rate of 200,000 to 220,000 tons a week.

John Willard, a public relations man for the BN, said 20 to 22 trains, hauling 10,000 tons of coal each, already pass through the coal country each week over what has become an elaborate system of railroads.

ONE NEW LINE, constructed last summer, extends from Sheridan, Wyo., to Decker and north. Another spur has been built in the Colstrip area to accommodate exports from Peabody and Western Energy. And yet another will be built this fall in the Sarpy Creek area west of Colstrip to haul the coal expected to be mined from that area.

The spurs, built to main line standards, contain 100-car loops for loading and connect to the so-called "Laurel-Omaha" main line that stretches from eastern Montana to points in the Midwest.

Willard said construction of future rail spurs is uncertain at this point, depending on the needs of coal customers and the transportation needs of the miners.

Much more coal is expected to be extracted from eastern Montana in the future.

While 25 different companies are vying for land and mineral rights, actual intentions to mine remain somewhat nebulous at this point.

Two of the most overt

Reclamation isn't the only worry

By GARY LANGLEY
Gazette State Bureau

COLSTRIP — Reclamation is not the only environmental game in town.

"Of all the apprehensions I have about (coal) development, the ability to reclaim the land is the least," said Wallace McRea, who operates a ranch north of here.

However, reclamation is the most immediate concern in this coal country. It preoccupied the state legislature last winter before it finally passed what has been billed as the strongest reclamation act in the nation.

Partly because of the new law and partly to enhance their public image, coal companies seem committed to reclaiming the land and are willing to openly discuss their plans for it.

But there are some environmental questions they are not so willing to discuss.

One is their method of mining.

FOR EXAMPLE, two large beds of coal lie underneath the grassy rangeland near here. The biggest is the Rosebud seam, which lies anywhere from 40 to 110 feet under-

Fourth in a series

ground, and above the McKay seam, which is neither as large nor as rich.

The Peabody Coal Co. is extracting both seams. Western Energy is not, and the company has not given the public or state officials a solid indication of its plans.

Mike Hayworth, a tour guide at the mine, said the McKay bed was too high in sulfur content to be environmentally acceptable at this time for energy conversion.

"That does pose a problem," he said when pressed for an answer. "If they decide at some time they want that (the McKay bed), it would be pretty bad (taking) that overburden out again and taking the second overburden to get at it."

THE POTENTIAL problem concerns state officials, not only at Western Energy, but at other mines where second or even third beds of coal may not be taken during the first cut.

Basically, the concern is this:

After the first seam is removed and the land reclaimed, extraction of a deeper seam might become economically attractive later. Mining would mean ripping up the reclamation and digging even deeper than the first cut. Afterward, the area would have to be reclaimed again with the persistent uncertainties of success.

It worries Lt. Gov. Bill Christiansen, an eastern Montanan who last winter was named by Gov. Tom Judge as the state's coal kingpin.

"We're keeping the pressure on," he said in reference to Western Energy.

ANOTHER COMPANY, Westmoreland Resources, has three beds of coal underlying the future site of its mine in the Sarpy Creek area.

Christiansen said the company's officials have indicated in a mining plan that they intend to recover all three seams in the first cut.

Other environmental questions are even more complex and intricate.

Strip mining involves much more than mining or reclamation plans. It is a complicated process that could prove ecologically harmful, not only to the land, but to the air, water and lifestyle of eastern Montana.

Experts say full-scale strip mining could have dramatic effects on this area's water supply.

It has a naturally dry climate, and one immediate concern is a scarcity of water for reclamation.

IN THE LONG run, experts are apprehensive about the groundwater supply. In some areas, particularly to the south of here near Decker, coal can act as an aquifer — that is, it holds water that could supply wells. Once the coal is removed, the groundwater is lost. Concerned about the impact, experts have recommended thorough studies of the hydrology of eastern Montana before full-scale coal mining is realized.

Although most of the coal now is exported, energy conversion near strip mine sites is a distinct possibility and the cause of another long range concern about water.

Energy conversion will require tremendous amounts of water for cooling from the Missouri, Yellowstone, Powder, Tongue, Bighorn and Little Bighorn Rivers. Many experts say a shortage of water already is developing, particularly in the Yellowstone River drainage where water will be piped for the Montana Power Co.'s 700-megawatt generating complex here when it is in operation at a conservative estimate of 8,000 gallons a minute.

THE TREMENDOUS requirement for water also is expected to trigger a struggle among the corporations who are after it.

"The struggle for water is going to be something else," one environmentalist predicted.

A state official put it even more vividly and within the scope of the fierce competition that is expected among the coal developers.

"The acquisition of water rights is a struggle within a struggle," he said.

Even as the huge steel beams to support the generating plants are being erected here, caissons also are being built to support the sophisticated air pollution control equipment it will require.

During the past two years, Hayworth said tests have been conducted by Montana Power to determine the effects of such factors as wind currents and temperature inversions on the air.

NOT THE LEAST of the concerns is the social and economic problems that may be created by full-scale coal development and energy conversion. This area is not prepared for the population explosion that is expected to hit within the next few years, some experts contend.

For example, the Montana Power-Western Energy complex here will spark unprecedented migration during the next year.

Colstrip, a company town built by the Northern Pacific and now maintained largely by Western Energy, has a population of about 900. As construction of the power plants continues, the population is expected to be 1,600 next year and reach a peak of 1,860 in 1975. By 1980, the population is expected to level off at 1,780.

COLSTRIP IS connected to Forsyth by a poorly maintained two-lane paved highway and to Billings by an Interstate. But much of its link with another population center, Sheridan, Wyo., is a network of graded gravel and dirt roads. Thus, road construction, an expense to taxpayers, is a concern.

The high rate of growth will not be limited to Colstrip. Forsyth to the north and Hardin to the west also are expected to experience population booms.

According to one privately released environmental impact statement, Hardin, situated about 40 miles west of the coal deposits, will grow 101 per cent during the next 20 years — from 2,700 today to 5,500.

It already has had an adverse impact on the housing situation in Hardin.

"The initial activity connected with the coal fields has made housing very tight in Hardin," the report said. "Housing is virtually impossible to find and is priced unreasonably high."

HOWEVER, THE development of coal and growth connected with it is expected to also boost Hardin's economy and tourist trade potential.

A third major projected growth area is Forsyth, a railroad town of 1,900 about 30 miles north of here.

Forsyth is expected to grow at an annual rate of five to 10 per cent during the next five years.

Already motels are filled to capacity every night as a result of the initial coal activity. To plug the gap, a new one is being built. Moreover, Gene Tuma, the city's mayor and also a top official in the Peabody Coal Co., said three water and sewer special improvement districts were initiated recently.

"I'd like to think that we're going to stay ahead of the development," he said. "It takes planning."

IF POTENTIAL development causes concern, so does the lean end of a boom-bust syndrome that some fear will hit hard after the coal has been extracted. While population projections abound for the time during which the coal will be mined, few predictions extend to the period after development ends.

The growth will require an essentially rural area to face the problem of sudden urbanization along with the accompanying problems of crime and overcrowding. It will require greater government expenditures for highways, police and fire protection and sanitation facilities among others.

"The people are not prepared — socially, economically or psychologically," one eastern Montanan said.

The boom-bust is a prominent concern of many experts and most environmentalists, but some say the anxiety is not justified.

"This is going to be here for a long time," Tuma said. "Colstrip already has been through it once, (and) there wasn't a major disaster when the mine closed down."

(Next: The new range war)

State's heated rocks a wellspring of energy

By NORMA TIRRELL
of the Helena
Independent Record

Possible gratification of the nation's indulgent appetite for energy and maybe even an answer to the state's quest for new sources of revenue lies beneath the earth's surface about 20 miles northwest of Helena.

A concentration of what has been termed "abnormally high geothermal heat flow" has been located in the Empire Gulch area near Marysville. Depending on the results of heat flow, gravity and seismic tests now being run in the area, the underground discovery may eventually be tapped as a new energy source—geothermal power.

In fact, geothermal sources are regarded by many scientists as the greatest untapped energy resource in the country, perhaps the energy equivalent of the total U.S. coal reserves, according to research from Richland, Washington's Battelle Pacific Northwest Laboratories.

Battelle is leading the Marysville investigation, with additional scientific studies being conducted by Southern Methodist University, and site preparation and some drilling being done by Rogers Engineering Co. of San Francisco.

Supplementary magnetic field and heat flow studies, water samplings and electrical resistivity studies are planned over the next three years by the U.S. Geological Survey and the Bureau of Land Management. The geothermal site is on BLM property.

The initial phase of the study is being funded by a \$250,000 grant from the National Science Foundation, with another \$2.25 million anticipated if preliminary resource surveys prove successful.

The Marysville site was selected from results of a 1966 study by David D. Blackwell, chief scientist from SMU. According to project manager Dr. William R. McSpadden, senior research scientist from Battelle, Blackwell was conducting routine heat flow surveys in the general area between the Dakotas and the Pacific Coast.

"The geothermal site near Marysville was the hottest one he found in that entire area," McSpadden said last week. "We suspect there are many more unknown geothermal sites in this Western region."

Concerning potential commercial value of geothermal sources to the state, McSpadden said a cubic mile of heated rock, if cooled by 300 degrees centigrade over a 20-year period, would be worth about \$25 billion, based on the current rate of electricity charges.

The real energy source is the plastic zone, about 60 miles underground where temperatures run about 1,000 degrees Fahrenheit, liquified by natural shifting and faulting, travels upward through ducts within the pluton, or body of solidified igneous rock.

"We won't be drilling into a live volcano, but into a big hunk of dry, solid rock," the Battelle scientist said.

In this way, the Marysville project is unique, for no one has yet tapped dry rock as an energy source.

In order to transpose the high temperatures from Montana's dry rock into useable energy, cold water must be pumped down into the pluton, thus producing steam for a turbine.

The water is injected through a deep well, which is scheduled to be sunk about a mile into the earth at the Marysville site next summer.

McSpadden described the operation as a closed system since the steam will be condensed back into water and reinjected down to the hot rock.

Geothermal energy is lauded as one of the cleanest, most non-polluting forms of energy because it requires no fuel.

"Instead of burning fuel to produce the steam, the earth itself serves as the source of heat," McSpadden said. "And we don't have to disturb or remove any of the earth's resources to extract the heat."

For this reason, he said the project has met with no opposition from environmental groups . . . only questions from people who are curious about the operation."

The U.S. Geological Survey classifies anything with a heat flow unit above the number of three as a known geothermal resource area, McSpadden said. In all of the 15 shallow holes already sunk in the Marysville area, scientists encountered heat flow units higher than three, he added.

"The highest area, found near the Empire Mine, had a heat flow unit of 19.5," Dr. McSpadden said.

An earlier Department of Interior study revealed that about 3,834,000 acres of Montana land, mostly along the eastern slope of the Continental Divide, have potential geothermal value.

The only operating geothermal power plants in the country, at Geysers, Calif., use natural steam from underground sources, unlike the dry rock makeup in Montana.

The Geysers plant can now provide half the power needs of San Francisco, according to Battelle research.

Marysville site is an ideal situation, McSpadden said, because it is central to the state's primary power users—Billings, Great Falls, Butte, Anaconda, Bozeman, Helena, Missoula and Kalispell.

The three-year plan for the Marysville site doesn't include actual construction of a power plant. Dry rock geothermal sources are still speculative enough that private industry "won't jump in," according to McSpadden. That's why the National Science Foundation issued the initial grant—to get the ball rolling on geothermal energy potential.

After the deep well has been sunk at the Marysville site, scientific and economic estimates will complete the current project. Dr. McSpadden speculated BLM will probably put the area up for competitive bidding for geothermal lease rights.

Coal unknowns may harm us

By MICHAEL WENNINGER
Gazette Staff Writer

It's what you DON'T know that can hurt you.

And what Montanans don't know about the consequences of coal development can be hazardous, according to a report by the Montana Coal Task Force.

The special group formed a half-year ago by directive of then-Gov. Forrest Anderson is distributing its "coal situation report."

IT HAS 72 pages, but the situation in Montana is summarized well in the short preface, which includes these comments:

"Although covering a wide range of subjects, the report is acknowledged to be incomplete in many respects. Evidence is fragmentary and inconclusive, and the fact remains that we know very little.

"In trying to determine the inter-relationships, assess the trade-offs, and agree upon an acceptable balance between coal development and environmental integrity, we have continually encountered unknowns or unmeasurables. Also disconcerting are certain contradictory findings."

THE PREFACE continues, "Even though we lack adequate understanding and agreement on the specifics and magnitudes of our present and potential resource and human problems, we have no disagreement about their urgency and the need for further understanding of the immediate and long-range consequences of any level of coal development or nondevelopment."

The seven-member Coal Task Force is headed by Gary Wicks, director of the Montana Department of Natural Resources and Conservation. Six other state departments and agencies are represented.

The task force has a seven-member staff headed by Frank Culber of the Department of Natural Resources, and there is liaison with the Montana University System.

THE REPORT states, "A functional, soundly-based regional plan relating to coal development requires a body of background information that is currently lacking. Urgently needed are:

"1. A comprehensive study of effective reclamation practices.

"2. A detailed analysis of Montana coal to determine the amount of trace elements and heavy metals present.

"3. More work on the effects of sulfur dioxide and other emissions on the rangeland ecology.

"4. A study of the problems associated with burial of fly ash in spoil banks.

"5. An in-depth study of government and industry research priorities. It would be important to know how much is being spent on the search for more efficient and less degradative means of electrical generation and transmission, as well as for new generation techniques.

"6. A comprehensive regional meteorological survey of the eastern one-third of the state.

"7. Specific knowledge of the environmental problems involved in moving coal by slurry pipeline."

Following the list is this underlined comment:

"ABOVE ALL, if the planning efforts of Montana and other coal reserve states are to have any hope of success, the most imperative needs are for state self-determination in resource use and for a national energy policy and a national program to moderate energy consumption by encouraging conservative rather than maximum energy use."

The Coal Task Force makes nine recommendations in the report, which has been sent to Gov. Thomas Judge. Most of them are covered in bills being debated by the legislature, but one recommendation is that Montana get help from the federal government.

"The potential impacts associated with coal development in eastern Montana are of such magnitude and diversity that the state and local governments cannot fully cope with pending problems," the recommendation says.

"BECAUSE THE situation arises from the increasing energy demands of the entire nation, and because energy-conversion companies presently do not bear the entire costs of development, the federal government should assume a large responsibility through funding needed research and providing impact funds for the local communities affected."

What is the situation in Montana? According to the task force's situation report, it is this:

"Potential utilization of Montana's coal, an immediate but possibly short-term energy resource, is probably the most critical social, environmental, legal and institutional problem facing Montana.

"... While energy will be transported out of the state, major impacts will remain in Montana—costs borne by the citizens of Montana, not the ultimate users of energy."

Coal region scrutinized

By DAVID T. EARLEY
Gazette Staff Writer

The coalbelt extending from the Bull Mountains to Gillette, Wyo., was scrutinized last weekend by Richard Cartwright Austin, a coordinator in the nationwide antistripping movement.

The area typifies, says Austin, the state of reclamation in the country — and the regional problems to be solved if environmentalists and miners are to lie down together as the lion and the lamb are expected to some day.

Included in the coalbelt are such other environmental hotspots as Sarpy Creek, Birney, Colstrip, Decker and the Acme pit near Sheridan.

Plans for development of this black wealth — containing most of the region's estimated 22-million tons of strippable, low-sulphur subbituminous and lignite coal — have thrown environmentalists into black depression.

RECLAMATION WON'T WORK in areas such as the Bulls and at Birney, they say, and won't be made to work in the other areas.

Local groups of owners, users and preservationists of the land banded together recently to form the regional Northern Plains Resources Council — joining their voices in loud enough song, they hope, to embarrass the mining companies if not state officialdom.

Austin, director of the Appalachia Strip-Mining Information Service of West Virginia and Washington, D. C., took a council-guided tour of the area last weekend.

In summing up his impressions for The Gazette, he lent substance to the council's fears and explained his proposals for easing the strain between strip-mining and the environment: an outright ban in some areas and regulated confinement in others.

AUSTIN IS A FORMER research assistant to antistripping Congressman Ken Heckler of West Virginia, and predicts victory soon in efforts to outlaw the practice completely in that state.

He does not, however, advocate a nationwide ban on strip-mining, he told The Gazette. It would be nice, but . . .

Reclamation is practically impossible in areas such as West Virginia's up-and-down countryside, says Austin. And a bill under consideration in Congress would prohibit the depositing of overburden (to expose the coal beds) on slopes steeper than 14 degrees.

This will put West Virginia out of the strip-mining business if local forces don't do it first, says Austin, and would necessitate great selectivity in mining Montana's Bull Mountains.

THAT'S IF ECONOMIC FACTORS hadn't already made it seem certain, at least to Austin, that stripping will have a short future in the rough country northeast of Billings.

It's a matter of economics, he explains. The Bulls' 10-foot seam of coal doesn't pay enough per acre to finance adequate reclamation.

This is evident, says Austin, after an inspection of the 15-acre pit from which Consolidation Coal Co. took some 50,000 tons last fall to test in Midwestern power plants.

Approved by State Land Commissioner Ted Schwinden, Consolidation's reclamation project was to try out different angles of slope on the sidewalls and spoilbanks to determine which works best in the Bulls' arid soil.

TO BEGIN WITH, says Austin, all the slopes are too steep. The gentlest, he says, is 2.5 to 1 — "about a 40 per cent slope when 12-14 per cent is the steepest which would allow soil stability.

"This is too steep to plough laterally. There's gullying already. It will erode, and if there's a heavy rain there will be earth slides."

It might have helped if Consolidation had pushed the overburden back into the pit and then piled on the small amount of top soil-scraped off the underlying shale. But the company didn't.

"There's a big hole in the ground with a great mound of shale beside it . . . the mounds look like some sort of religious gestures.

"THE PIT STANDS there as a witness to the fact that reclamation isn't going to mean anything in the Bull Moun-

tains, with the state as an official witness."

Back to economics.

The thin soil should be fertilized, seeded and turned under and then re-worked, says Austin. Adequate reclamation would take five years and about \$4,000 per acre.

With a 10-foot seam of coal Consolidation just can't afford adequate reclamation in the Bulls — even if the state required it.

(Austin's prediction of little future strip-mining in the Bulls is based on an assumption that federal law will eventually do what the state can't do for itself — require reclamation.)

The situation is different at Decker, says Austin. "Although we didn't see any satisfactory reclamation on the trips they talked a good effort at Decker."

THE DIFFERENCE, says Austin, is in the thickness of the coal seam: 50 feet. Decker Coal Co. can produce 4 million tons of coal a year and disturb only 40 acres of land.

The manager at Decker told him frankly, says Austin, that the company is all for strict reclamation requirements. With such a thick coal seam Decker can afford the best and watch its competitors starve.

Country with a lower profile can be reclaimed, says Austin. And mining companies can afford it if the coal seam is thick enough: improving the ratio of recovered coal to disturbed acreage.

Nationwide, however, the mining-reclamation matter "is a growing mess."

With the exception of a few show-case "Potemkin Villages," says Austin, "there isn't any acceptable reclamation now being done."

He estimates that 99-95 per cent of strip-mined land remains a burden to nearby communities. And while strip-mining is increasing — to 50 per cent of the nation's 600-million ton production this year — opposition increases as rapidly, says Austin.

HE PROPOSES better laws and direct political action to ensure enforcement.

West Virginia and Kentucky are among the states having the toughest laws, he says — and also enjoy some of the gaudiest spoilbanks in the country.

In the former state, where the ex-parson headed a Presbyterian mission for six years before adopting opposition to strip-mining as a way of life, political action is the method.

Antistrip-mining sentiment manifested itself in the recent primaries there, says Austin, and “company” politicians were rudely surprised. Since West Virginia is virtually a one-party state, he adds, the people’s expression of dissent is decisive.

But Montana is about 20 years behind West Virginia, says Austin. “We’ve been through five laws, since 1939.”

Local groups and the regional Northern Plains Resources Council have two jobs to do, he believes: put the “company” politicians on notice, and gain passage of laws which regulate strip-mining.

AUSTIN BELIEVES mining and reclamation must be regulated on a regional basis and confined in enclaves.

A regional overview reveals, for example, that reclamation in the Bulls — difficult even when adequately financed — is virtually impossible.

At Decker, however, and granting that stripping must be allowed somewhere, the terrain allows for better reclamation and the richness of the bed will pay for it.

Regional regulation would allow strip-mining one place and not the other: “strip-mine zoning.”

The next step should be confinement, says Austin, keeping the mines and the power plants grouped for easier regulation.

BY GROUPING, he explains, it will be easier to assess the total pollution going into the air and the streams.

“If you cluster them you can have closer regulation . . . one reason why they’re scattering the power plants they’re building now.”

The richness of the Montana-Wyoming field lends itself to this, Austin concludes.

“The quantities of coal here are so vast that with any sort of decisive regional planning you could confine its impact in the foreseeable future to, say, a 50-mile radius of Colstrip and Gillette.”

Voice of the Readers

Letters in Voice to the Readers are limited to 300 words and subject to editing for clarity, libel and length.

Factual approach needed

I agree with the person who wrote you recently and said the Gazette is creating hysteria with its articles and editorials against the coal and power developments near Colstrip. I suppose that is your way of insuring that the squeaking wheel gets the grease.

Being uninformed as I am, what is needed is a more factual approach. For example, to state

that our rivers will be dried up by cooling water usage without saying what portion of available water will be used is shooting from the hip. The same applies to the implication that all of Eastern Montana will be destroyed.

Whether or not you are correct, I don't know, but I am not prepared to support your stand based on what has been written

so far. I could research this for myself, but I think it is the Gazette's job to inform us based on facts.

The tone of the articles and letters in the Gazette imply that part of the antagonism toward the Colstrip development comes from the Montana Power Co. being involved. Whether or not the MPC is a good citizen for Montana may be debatable. It can defend itself.

A factor that should be considered in this situation is the good that can come from it, benefitting both Montanans and others. Unless a tremendous hoax is being perpetrated on us, there is an energy crisis developing that involves electrical power and the fuel required to produce it, in this case coal. Why shouldn't Montana have opportunity to benefit from it in increased tax revenues, added payroll, etc.? To say that the development should be stopped unconditionally is not the answer.

The development should be allowed, but with specified rigid conditions that the developers would have to agree to meet. There should be legal recourse with severe monetary penalties if the conditions were not met. If it's necessary to have air cooling towers for a power plant instead of water cooling towers in order to protect water quality and downstream water users, then let's insist that it be air cooling towers. If it's necessary that fifty or more attempts be made in order to acceptably restore disturbed land instead of two attempts, then let's insist that it be whatever number of attempts are necessary.

Let's insist on whatever will be necessary.

Gordon D. Lanouette
Sheraton Arms

E.L. Ruffier
1804 S. Mariposa Lane

Do they get both sides?

An article in your paper "Students get involved in strip-mining issues," told about how Billings students, EMC and Rocky Mtn. students are being encouraged to protect and preserve the environment. Teachers and educators were quoted as saying the students are being given both sides of the environmental issues so they can decide for themselves. In my opinion that is not true.

The teachers say that industry spokesmen are given a chance to state their case. Do they have equal time? The teacher has much more time and also the last word. A teacher or professor teaches a particular subject year after year and gets to know it quite well in spite of how little intelligence he might actually have. However, the average student and even the college student has the subconscious impression that, because the teacher knows a difficult subject well, he must also know a lot about

other things. This is how a prejudiced teacher or professor has an inside track to a student's mind. He has an unfair advantage which some of them exploit.

I listened to a local professor rant and rave before a service club about the destruction of the environment. It left most of the mature audience cold, but I know that most of his students (my son included) agree with him 100 per cent. The sad part about it is that these students are brainwashed by a crackpot environmentalist. I believe that the environment should be protected, but I am not hysterical about it. Being an engineer I have somewhat of a scientific background, and I don't believe many of the figures that ecologists give us. It isn't a simple black and white issue as they would have us believe.

If it weren't for the extractive mineral and fuel industry our

standard of living would be so low that most of us probably wouldn't even exist.

The Billings Gazette is also taking unfair advantage of a captive audience, since it is the only paper in town. Every paper is supposed to write an editorial now and then, but you are overdoing it. I am talking about your unreasonable stand against strip-mining and the front page editorial. Most people I know are not interested in your opinion about anything. There are other things about the Gazette that I don't like, but that is unrelated to the subject. A decent newsworthy paper in Billings would be a nice thing to have.

Regulate, don't stop

I'm sorry to see that The Gazette has adopted such a stiff-backed environmental policy. I've found that it is hard to talk any sense into the head of a real far out environmentalist. I suppose that you will now be that way that you have started waving their banners.

I do think that it might be good if you did a little further investigating by sending a good man to get a look at the giant Leland Olds Steam Generation Plant down the river in North Dakota. This plant has helped serve seven Missouri Basin states including part of Montana. At present it is being enlarged to more than double of its size and capacity.

The Colstrip mine was opened near fifty years ago. There has been a tremendous amount of coal removed by the operators since then. Still there has been no great area of land gobbled up. The spoil banks cover an area of land that would only make one modest family sized ranch. During the busy years of this operation hundreds of jobs were enjoyed by the job-hungry people of the area.

There is now a start at restoring the spoil banks. The emissions from the generation plants are being cut down. There is a demand for the coal. There is unemployment. All those are GO signs for industry.

As for breathing the smog that would accumulate while generating power for the Eastern states it might be nice if we would repay our Eastern neighbors for putting up with the smelting of the iron and all the ills that went with it. We are using a lot of wonderful machines that took a lot of smoke to build.

As for the water that would be used from our rivers. It is high time to find some use for it as it runs to the ocean. If we use it here in Montana we can cease worrying so much about it. It is going to keep on running for a long time.

Pulling for regulatory laws may be a real progressive action. Trying to establish STOP signs for industry can not be regarded as progressive. I'd like to see a little more vision than that.

Ray Horton
Fishtail

Love America, too

Ho, hum! If Montana resources don't die in the ground where they are now buried, they will surely be talked to death before the individuals or developers even remotely approach their true worth to the over all survival picture that raw energy-producing states such as Montana will be relied upon to provide stop-gap fuels to aid in the continuation of the life-style to which we Americans have become accustomed.

The typewriter that you pecked out your editorial on for this morning's Gazette was produced in one of those energy-robbing states, by employees who must live and work there, and who are entitled to continue their life-style as well. Where would you be without your automobile(s), television set(s), home appliances, clothing, the food on your table, your printing presses, your newsprint rolls, your printing ink . . . and on and on and on.

If you and other "anti-energy" individuals or groups would just analyze your thoughts before they became a matter of public record via the news media, you might come up with some constructive observations that

would lead to eventual mutual harmony between all parties concerned in this acute national emergency that is fast before us. I love Montana, but I also love this America of ours, and unless we stop being "hoarders" of our individual states needed resources, other states not excepted, we will wake up one morning and face an emergency the magnitude of which is not even comprehensible to more learned minds than yours or mine in the matters of energy "survival" of our country.

I do not believe that Colstrip, Sarpy Creek, Bull Mountain or Decker will become the "Death Knell" for Montana. But I do believe that Montanans can continue to be talked into the grave, day by day, year by year, generation by generation as they have been in the past.

I think it is time we all reviewed our operating manuals and in proper sequence "start brain before engaging mouth." This, too, can become a major source of pollution in Montana if not properly monitored. Idling motors traverse not surmountable obstacles.

Gene Strosky
Hardin

Teacher's view

Coal means a question mark

By HELEN M. PETERSON
Editor, Hardin Tribune Herald

HARDIN — There are three operating mines and many more proposed in the corner of south-eastern Montana bounded on the north by the Yellowstone river and on the west by the Big Horn river.

Members of the Montana Environmental Quality Council saw them on a recent tour and asked lots of questions.

Coal officials answered some questions — and dodged others.

At Decker, a 52-foot seam of coal has been uncovered and is being mined and loaded into unit trains by 40 people. One was being filled with coal when the tour stopped at the mine.

The unit trains are composed of 100 cars, each holding 100 tons of coal. They travel some 1,100 miles to Illinois, where Commonwealth-Edison uses this low-sulphur coal in a steam generating plant.

As coal is mined, it is stored in two silos, each holding more than 13,000 tons. A conveyor belt carries the coal, broken into pieces an inch or two in diameter, over the railroad track and then a precisely timed, automated operation begins.

The coal cars travel at something like five miles an hour. The coal flows into them through a chute from the conveyor belt — and the flow is automatically controlled, too, so that it is shut off between cars.

Four locomotives, placed front, back and in the middle, propel the load across Wyoming and the Midwest.

HOW MUCH A TON is Decker Coal paid, somebody wanted to know. Jack Ratche, representing the coal company, never answered precisely. He said price was governed by ash and water content and by its BTU rating (a measure of the amount of heat produced when the coal is burned.) Sulphur content is tested, too, and a train-load of coal could be refused if the sulphur level were above the limit placed on it by law — but Ratche doesn't think that will ever happen. It is averaging one tenth of one per cent, he said.

At present three train loads are being shipped a week. By the first of the year, Decker Coal expects to be shipping eight trains a week. That's a little over four million tons of coal a year.

Asked again about proceeds to the coal company, Ratche commented: "Well, I'll tell you this. It's costing over twice as much to transport it as we're getting for it here at the mine."

Will Decker Coal eventually build a steam generating plant?

That is not in future plans — but that's no assurance such a plant won't be built. Pacific Power and Light is a partner with Peter Kiewit and Sons at the Decker operation — and PP & L has other leases. If a power plant is built, the power company will build it.

THE COAL SEAM at Decker is 52 feet deep. The top half has less sulphur. The coal company is harvesting 85,000 to 90,000 tons to the acre, and that's just the top seam. The overburden is about 70 feet, but it is deeper in spots. Then comes the first coal seam. There's another 60 to 70 feet of overburden and then another 26 to 28 foot seam of coal. The company isn't planning to take the deeper seam, Ratche said. However, he added, "We're going to study the possibilities."

A new dragline for removing the overburden has just been assembled at Decker, with a bucket capacity of 41 cubic yards. It was purchased in September, 1971, and it took just a year to get it in operation. A 16-cubic-yard shovel is being used over the coal sea.

After those top layers are peeled off and the coal exposed, it is loosened by blasting, loaded in trucks and transported to the silos.

The coal bed at Decker is an aquifer — that is, it bears water. This necessitates a continuous pumping operation. Removal of the coal may also affect the water table at Decker, but so far, according to Wayne Van Vost of the U.S. Bureau of Mines, the water table has gone down only a little. Fourteen observation posts have been established, he said, to measure what happens.

THE SPOIL MATERIAL, which will go back in the hole, will not be "as permeable as the original aquifer," Van Vost said. "In essence, we're going to lose an aquifer."

Scoria — ashes of a burned out coal seam — is a prolific byproduct at Decker. It's useful at the mine for surfacing roads and the like — up to a point.

There will be much more than the coal company can use. Roads in the area have long been surfaced with scoria.

Later in the day the Council and accompanying party drove through the Birney-Decker area and were briefed by Bureau of Land Management and Forest Service personnel on the coal to be found there. Almost the whole region is underlaid with coal seams.

Particular interest was shown in one site which a coal company proposes to lease. It is just west of Birney, and one of the rare streams in the area, small, cold and clear now, runs through it.

At Colstrip, the Western Energy mine was toured in a school bus borrowed for the occasion — since Western Energy has a rule which permits only five visiting vehicles in the mining area at a time.

Here draglines were scooping the coal into the huge trucks which take it to waiting railroad cars. Most of this coal goes to Montana Power's Corlette plant in Billings.

There's a second coal seam sandwiched below the one now being mined at Colstrip, and Western Energy apparently plans to leave it in the ground.

Some of the equipment being used at this mine has been there a long time.

A dragline used by Northern Pacific some 30 years ago is still functioning.

ABOUT SIX MILES southeast of the Western Energy operation, Peabody Coal Co. has established its Big Sky mine. The coal is being shipped by rail to Minnesota, where it is being used for electrical generation by Minnesota Power and Light.

The visitors were not allowed to leave cars here — because Peabody could not furnish hard hats for so large a group.

Both coal seams are being taken at the Big Sky mine.

A drive across pine-clad hills brought the EQC and company to the site already acquired by Westmoreland Resources or, Sarpy Creek.

Here they were met by Pemberton Hutchinson, president of the company, Ralph Moore, general manager for operations, John Althouse, chief engineer, and Matthew S. Tudor, geologist.

The coal here belongs to the Crow Indian Tribe — but the surface was homesteaded or purchased by non-Indians. It was opened to settlement some 50 years ago, when the so-called ceded strip along the north edge of the Crow Indian reservation was detached and opened for settlement.

Westmoreland is going to have an immense dragline with a 75-yard bucket. It will be assembled on the site, and was designed by Morrison-Knudsen, which is a part of the combination of companies that forms Westmoreland.

Operations are scheduled to begin in 1974, Hutchinson said. When mining is in full swing, there will be about 120 employees. Westmoreland, like Decker Coal, expects to ship in unit trains. Its coal will be sold to a utility — unless a gasification plant is built on the site. This would probably use all of the fuel the coal company could furnish.

WESTMORELAND HOPES to cover an area of about 50 acres the first year — then 150 acres a year thereafter.

Coal from this mine will not be exported outside the United States, Hutchinson told a questioner.

All the coal within reach will be mined. The dragline is designed to take both of the coal seams in the Sarpy area. Here the formations called the Rosebud and the McKay run together, to make a layer of coal 35 feet thick. The overburden is favorable — about 70 feet, but it is a rolling country and will be deeper in some places. Under the first coal seam is a layer of silty shale and other material about 60 feet in depth — and then 20 feet more coal, designated as the Robinson.

These mines literally only scratch the surface in southeastern Montana. Both the Cheyenne and Crow Indian Reservations have large coal deposits, and there is much land the U.S. government, by reserving mineral rights, owns the fossil fuel. There's coal under lands in the Custer National Forest, too.

A large portion of the area is under exploration permit, with probably a dozen coal companies involved. Peabody and Consolidation Coal have large areas under exploration permit. Shell Oil has signed a production lease with the Crow Tribe. Gulf is another major company that has shown interest in this area.

Power companies, too, are exploring for good coal mining sites. All of southeastern Montana will see the huge shovels and hear the rattle of the coal trucks and the unit trains before many more years have passed — unless new sources of energy are found very quickly, or legislation slows coal development.

Consol already fined by state

By DENNIS E. CURRAN
Gazette State Bureau

HELENA — Consolidated Coal Co. hasn't started to strip mine coal commercially in Montana yet, but already it has a few black marks on its record, including a \$500 fine for breach of reclamation contract.

While generally cooperating with state officials, the giant Pennsylvania mining firm has compiled a mixed sweet and sour record in its dealings with the state Department of Lands over reclamation of a test mine in the Bull Mountains south of Roundup.

"They've been reasonably cooperative, and at the same time we have had some serious difficulties with them," says John Goers, administrator of the Land Department's Reclamation Division, nodding at an inch-thick file on Consol.

Officials of Consol, as the subsidiary of

Continental Oil Co. is called, outlined reclamation policies at a press briefing Tuesday with a claim that eastern reclamation has actually improved land productivity and a pledge that Montana's vast coal fields would not be discredited like Appalachia.

GENERALLY the company has made a good faith effort and has been more cooperative than some other coal companies, Goers says.

However, the Land Department file reveals that the route to good reclamation in the Bull Mountains has followed a somewhat winding path.

Consol's reclamation plan had to be rejected four times, says Goers, adding that the first plan was "a piece of trash" which was long on nice-sounding goals but short on specific commitments.

Then came the fine. Last Nov. 5, Land

Department inspectors warned Consol that it had reached the test pit boundary set by the land reclamation contract. A subsequent inspection revealed that Consol had extracted more coal, and on Nov. 24 Land Commissioner Ted Schwinden informed the company that it had breached the reclamation contract.

THE LAND Department met with the attorney general's office and prepared for legal action. But Consol quickly paid a \$500 fine, and the case never went to court.

The company later sought and received an amendment to the contract which revised the boundaries slightly. Schwinden said the new boundary was actually more desirable because it reduced the total pit area and the amount of overburden (soil on top of the underground coal seam) involved. The Land

(Continued on Page 9.)

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Consol

Department's advisory committee was polled and agreed, according to the record.

Goers told the Gazette State Bureau that the land involved was less than one acre—"a very small piece of real estate."

"The main thing the fine established was a principle," he said. "The principle had to be established that you stay within the contract boundaries."

SINCE THE FINE, Consol has been very cooperative, according to Goers.

The Bull Mountain test pit was undertaken by Consol to determine quality of the coal, but at the urging of the Land Department it also became a test for various reclamation techniques.

The 12-acre test area about four miles south of Roundup has been reclaimed through grading and seeding of soil banks, but the final results won't be seen until the end of another growing season.

The company varied the angle and grade of slopes and also experimented with different surfaces of topsoil, sandstone and shale. While the tests results still aren't final, topsoil apparently produced the best revegetation, shale the worst.

ACCORDING TO Goers, the test results will aid the Land Department in its repeated efforts to get not only Consol but other coal mining companies to cover their spoil banks with topsoil.

And Consol, in its press briefing Tuesday, seemed to indicate that it would follow the topsoil approach, even though it is more costly.

"We will do whatever's necessary to provide the best, and if that's the case (topsoil being the best), it would be done, said Dell Adams, vice president for operations on Consol's western division.

Much of the two-hour press briefing was devoted to environmental concerns, and the company officials repeatedly expressed their commitment to doing the best job possible.

Goers told the State Bureau that he has every reason to believe that the company will fulfill its pledge. But he added that he will continue to watch them closely.

Consol, which calls itself one of the two largest coal miners in the world, now holds 1.2 billion tons of coal reserves in Montana and is seeking more. The company also seeks long-term coal contracts with eastern utilities.

Fuel-Pinch Factors: Time and Imports

By MAX B. SKELTON
AP Oil Writer

HOUSTON, TEX. — (AP) — Two Interior Department officials agree that imports and time are the major factors for solving the nation's energy problems.

Stephen A. Wakefield, the new assistant secretary of energy and minerals, says imports will ease the problem, but won't cure it.

Duke R. Ligon, the new director of the office of oil and gas, sees imports as the major tool for use in a period of transition that will serve as a time bridge between two eras of adequacy.

Both say the nation has ade-

quate resources but that it will take time to correct past mistakes.

"Meanwhile, the remedy for our immediate discomfort is increased oil imports," Wakefield says.

DOMESTIC FUELS

"Our challenge right now is to get domestic fuels into the marketplace in order to mitigate shortages and to decrease international competition for fuels," Ligon says.

A reorganization approved by Secretary Rogers C. B. Morton early last week centers Interior's energy, power and mineral functions under Wakefield, whose title is a new one within the department.

Wakefield says the diagnosis is the nation isn't short on resources, not even oil and gas, but is short on incentive to develop them.

"And at this particular moment in our history we are also short on time," he says.

INATTENTION RESULT

Wakefield describes the current shortages of natural gas and petroleum products as the legacy of almost two decades of inattention to the developing problems of domestic energy industries.

"Now we are starting to correct our past mistakes and neglect, but the critical element that we irretrievably lost is time," he says.

Wakefield outlines the time problem this way:

—It takes three to five years to bring a big new coal mine into operation and about the same length of time to find and develop an oil or gas field in a known productive area.

—A new refinery takes from two to four years to build even after the necessary permits are obtained.

—A new marine terminal can be in operation in five years if everything goes well.

—Electric power plants take from seven to 10 years depending on whether they are fossil fueled or nuclear.

"All of which is a way of say-

ing that things are going to get worse before they get better, even if we start out doing all the right things tomorrow," Wakefield says.

Wakefield adds that imports already are coming overwhelmingly from the Persian Gulf, and, also overwhelmingly, are high in sulphur content.

"And this is giving us more problems than we can say grace over, I can tell you," he adds.

"Would you believe a million barrels a day in imports from the Persian Gulf alone this year?" he asks. "This is what we are forecasting. Our total oil imports, from everywhere, are expected to reach six million

barrels a day this year." Most domestic refineries designed to process sweet crudes.

INCREASE DUE

The mid-year supply demand report just released by the Independent Petroleum Association of America forecasts 1973 imports will average excess of 6.1 million barrels a day compared with 4.7 million a day in 1972.

President Nixon's April proclamation abolished a year-old mandatory oil import control program in favor of a license-fee system which would be waived for the first five years of operations for new domestic refinery capacity.

All 4 coal firms in state file for permits in time

HELENA (AP) — All four firms currently mining coal in Montana met the deadline Thursday for filing applications for strip-mining permits with the State Land Department.

In addition, a fifth firm, seeking to begin mining next January, also applied under the new strip-mining law, called the strongest in the country.

The Land Department noted receipt of applications from Peabody Coal Co., Western Energy Co., Knife River Coal Mining Co., Decker Coal Co. and Westmoreland Resources. At the same time, the Department of Natural Resources and Conservation said notices were sent to all of the firms except Westmoreland that existing contracts for mining would be cancelled in six months.

Westmoreland wants permission to begin seeking a return next January on its \$30 million investment in the Sarpy Creek area of Big Horn County in southeastern Montana.

Peabody Coal Co., which has publicly stated it seeks to be the "leading environmental coal company" in the state, indicated it is planning to put up substantial funds to meet that claim.

Its application stated the firm estimates the cost of reclaiming each acre of mined land

will be \$6,500, more than five times the cost of the highest estimate among the four other companies. An official of Peabody confirmed that the figure was not a misprint on the application.

That figure is \$4,000 higher than the statutory maximum reclamation bond required to be posted by a mining company to insure revegetation of mined land.

Westmoreland said its estimated reclamation costs would be \$1,200 an acre. Other estimated reclamation costs per acre are: Western Energy, \$790; Decker, \$500; and Knife River, \$900.

The Strip Mining Reclamation Act of 1973 required firms already mining coal in Montana to apply for new permits within 90 days of enactment. That time limit expired Thursday.

The vital statistics of the applicants:

—Westmoreland — a partnership of the Westmoreland Coal Co., Philadelphia, Pa.; Penn Virginia, Philadelphia; Morrison, Knudson Co., Inc., Boise, Idaho; and Kewanee Oil Co., Bryn Mawr, Pa.

Intends to mine 76.5 million tons of coal from reserves of 1.1 billion tons between 1974 and 1995. It owns leases on coal owned by the Crow Indians

near Sarpy Creek.

The firm said it will disturb 250 acres of land in the next 12 months and a total of 1,200 acres in the 30 years of its projected mining operation. Coal will be mined from two seams.

—Western Energy — wholly owned by the Montana Power Co. It intends to disturb 85 acres in the next 12 months and 12,607 acres of land in the life of its operations. The company mines near Colstrip in southeast Montana. Western Energy is also seeking leases on 10,320 acres of land from the Bureau of Land Management for future uncommitted mining.

The firm is mining one of two existing coal seams and is removing 5.5 million tons a year. It will be mining as much as 13 million tons annually within the next five years.

—Decker — listed on the application as a joint venture of Western Minerals Inc. and Wyntana Inc., with the principals actually Pacific Power and Light Co. and Peter Kiewit and Sons.

It intends to disturb 55 acres of land in the next 12 months. Its operation, just across the Montana border north of Sheridan, Wyo., has incredibly rich 50-foot thick seam of coal. Mining, projected to continue through 1992, will disturb 1,500

acres of land and minerals owned by the state and federal governments.

The firm spent \$24 million establishing the Decker mine.

—Knife River — wholly owned by Montana-Dakota Utilities Co. The smallest strip-mining operation in Montana, Knife River disturbs 15 acres a year mining 330,000 tons of coal to fire generating plants of the utility at Sidney in extreme eastern Montana.

—Peabody — wholly owned by Kennecott Copper Co. It intends to disturb 148 acres near Colstrip in the next 12 months and 1,424 acres by 1982.

The company, mining two seams of coal, has commitments to supply 100 million tons of coal to buyers in other states.



that's what

By DUANE W. BOWLER
Editor, The Gazette

Coal strip mining of today should be an integrated practice, one that involves scientific planning from the thought to delivery of the black gold to market.

It is no longer sufficient to tear up the land, take out the coal and go merrily on your way with pockets jingling and bank accounts swelling.

THERE'S A MATTER of accountability to the future as well as the present. What happens after the coal is gone is as important as the use to which it is put.

In a paper on "Surface Mining Methods and Techniques," Elmore C. Grim of the National Environmental Research Center, puts the industry in perspective.

"All too often in the past, mining practices for mineral removal utilized the simplest and cheapest possible method, without consideration for preservation of land, water and air, and virtually no consideration for the rights of others.

"By necessity, a mining company is in business to make a profit, but every company, regardless of the nature of its business, has moral obligations to reduce undesirable effects on the environment and to safeguard the rights of others."

REDUCTION OF THE UNDESIRABLE effects on the environment and safeguarding rights of others are the key words insofar as the public and the future are concerned. The extractors can be relied upon to watch out for the profit aspect.

How do you reduce the impact of strip mining to acceptable, to most, standards?

As stated in Sunday's article, "Make your decisions for conservation."

THERE ARE WAYS in which the coal can be taken and the environment essentially preserved.

Grim outlines the basics in his "Surface Mining Methods and Techniques," published less than a year ago. Anyone who wants to become fully aware of what these methods are is advised to read it. Legislators considering laws governing coal strip mining should find it required reading.

The expertise to be found in it is based on years of experience in strip mine country and in dealing with coal strip mine operators.

The knowledgeable statements in it counteract some of the contentions made by those in the mining industry who are all for a strict strip mining law "but . . ."

FOR INSTANCE, Grim says reclamation work must go on almost simultaneously with the mining, not at the convenience of the operator.

The enforcing agency, in Montana the State Land Board, must have the right to specify the equipment to be used according to the place of operation.

Several states now require the operator to separate topsoil from the subsoil and to stockpile them separately. The materials then can be put back in sequence for the best chance at revegetation.

PARAMOUNT TO ALL reclamation is preplanning.

"The operator should determine not only the quality and quantity of the deposit, but also the quality of the overburden material, the water pattern within the area (both surface and subsurface), the location of abandoned or inactive underground mines, the adjacent land and water uses, and the topography," says Grim.

"Analysis should be made of the overburden materials to determine their texture (sandy, clay, silty) and their chemical makeup (i.e., which strata are acid producers, have nutrient value for vegetation, and contain toxic material). This information should serve as a guide for planning the mining operation and water control.

"Adjacent land uses and present use of the area before mining should be taken into consideration in planning the type of grading to be performed."

MINING ITSELF is an important step in environmental control including proper location of haul roads to prevent erosion. Removal and replacement of overburden are critical as is treatment of the pit to seal in toxic material.

Grim isn't hung up on "topsoil." He says to put the best soil on top and bury the less desirable.

RECLAMATION OF THE LAND should follow closely behind the mining operation. Freshly moved material is easier to grade and handle than older compacted material. The bare spoils and pits are more susceptible to erosion.

Revegetation should follow the grading as soon as possible to establish a quick protective plant cover with grasses and legumes on all areas. Trees may be planted in combination with grass but alone are not enough.

"Unquestionably, some of these mining methods and techniques require additional reclamation costs, but the costs of reclamation are minor when compared to the environmental benefits achieved and the areas of land restored to productive use," says Grim.

PLANS ARE NO BETTER than the manner in which they are carried out. That's where inspection counts.

Inspect often, say every two weeks, with the inspector having the power to stop the operations if the operator does not comply. Base your reclamation bond on what it will cost somebody else to do the job if the operator walks off.

Pretty restrictive stuff, isn't it?

Experience has shown that's what's necessary if there is going to be anything useful left after the coal is gone.

surface mining called efficient, economical'

by MRS. R. C. HURD
Gazette Staff Writer

GLENDIVE — Robert Matson, geologist for Montana Bureau of Mines and Geology, speaking on development of coal mining in eastern Montana at a meeting of the Economic Development Association of Eastern Montana, said "we have to have the coal. The only efficient and economical way to get it is surface mining."

He said underground mining can recover only 50 per cent of the coal, while strip mining can recover as high as 95 per cent. He said coal beds can be stripped and leveled, and 80,000 to 100,000 tons of coal per acre can be recovered. With a few cents per ton for reclamation, the land can be reclaimed for any purpose desired, he said.

MRS. JOHN CROSS, Glendive, a delegate to the Constitutional Convention, and chairman of the committee on Natural Resources and Agriculture, was in the audience and remarked that there had been no study made of the economic impact this strip mining would have on the state, although such a study had been asked by the governors of Montana, Wyoming and North Dakota.

Matson agreed that a great deal of research was needed, but added that he felt that it could be done. He pointed to what the Department of Agriculture had done for the farmers over the years as an example of research. He did not say that research study on strip mining or rather the economic impact of it, would be set up. He said, "I feel that it will take a very few miners and operators to get this job (strip mining) done. I do not see it as a great problem. I think we should just go out and get the job done."

MATSON SAID that about 90 per cent of the coal now mined in Montana leaves Montana. He said the development of any coal mining in Montana depends on the availability of water. He said all the available industrial water in the Yellowtail reservoir has been allocated to industry on an option basis.

No figures were given as to the amount of water to be taken from Montana's rivers and streams for the purpose of strip mining, but it was indicated that it was a sizable amount.

After the meeting ended, Mrs. Cross made this statement, "After attending the two sessions of EDAEM, and the banquet where Robert Matson spoke on Coal Development in Eastern Montana, I'm more than ever convinced that Mon-

tana must have a legislature with guts enough to pass legislation that not only regulates and controls strip mining, but can prohibit it if it is necessary.

EVENTS ARE happening so fast that few Montanans fully realize what effect the so-called coal development is going to have on their lives and on their environment. We will soon be in the position of locking the barn after the horse is stolen.

"If strip mining continues at its present pace, and if mine-mouth energy plants are a part of this "development," if the need for water is as great as has been announced, then agriculture as we know it now will soon be a thing of the past.

"Eastern Montanans should have the right to say 'no' if they so choose."

Diverse views merge on Montana's economy

Representatives of business, labor and government presented their diverse views of the Montana economy — and what to do to improve it — Tuesday night.

Speakers at the Billings Chamber of Commerce "Partners in Progress Dinner" at the Northern Hotel were Fred Barrett, head of the state Employment Security Commission, James Murry, executive secretary of the state AFL-CIO, and George O'Connor, president of the Montana Power Co.

Each defined his own field's role in the economy and discussed its benefits.

Barrett said the employment service "provided the missing link between the people looking for jobs and those who have them."

"OUR PROGRAM thrust is emphasis on stressing function . . . we will get out into the community and sell the agency as the agency to find the workers."

One of the means to reach this goal, he said, will be a compu-

terized job bank run on a statewide scope to provide better communication between those looking for workers and those looking for work.

The agency also handles unemployment compensation which in Yellowstone County alone has been \$602,899 since the first of the year.

Speaking for organized labor, Murray said, "Montana is one of the most highly unionized states in the country today."

"Our main job, though, is to present the case for people . . . and our actions benefit many more people outside the labor unions than in."

AMONG THE CAUSES he said labor unions have fought for and won are minimum wages, public housing, and public schooling.

"We're very involved politically and we're going to become more involved, militant, as time goes on," Murray said.

The president of Montana Power based much of his talk on

the energy crisis and Colstrip.

"We've become a nation of screamers," O'Connor said, "and I'm sure if you press the right button on any American, he will scream crisis."

"Montana is caught up in an energy crisis," he said, "and Montana coal is the key to solving the short term energy crisis."

HE SAID there were forces against the utilization of that coal which keeps men on their jobs and bolsters the state's economy.

"There is an anti-business attitude that is part of Montana's failure to reach its business potential."

O'Connor said "the greatest majority of the electricity we produce is used in industry—83 per cent is used outside of the home."

Already power shortages have caused layoffs and "the negativists in Montana" have not made one positive move toward improving employment, he said.

Colstrip plants will provide the electricity to keep industry operating and add 550 mining jobs and 850 non-mining jobs to the state's economy.

"IF WE DEVELOP an atmosphere in this state that stops this development, all the people of Montana will lose," he said.

Montana Power is considering forming an advisory body to bring in divergent outside interests to iron out problems, he said. Business, labor, and government "must learn to sit down together" and solve these problems, O'Connor added.

Labor's Murry agreed with business' O'Connor over the need for cooperation. "We have to work very hard that these differences are at a professional level but not a personal level . . . and have a public exchange of ideas and differences," he said.

Energy crisis growing, expert says in Billings

By MICHAEL WENNINGER
Gazette Staff Writer

The energy crisis is real, and it's going from bad to worse, a congressional technical aide said Friday night in Billings.

The speaker was Jack Bridges, technical director of energy resources for the Congressional Joint Committee on Atomic Energy.

Bridges summarized a report on the "national energy dilemma" prepared recently by the committee's staff. He said the report did not advocate a certain plan of action.

"We're simply trying to get them (congressmen) to focus on the magnitude and complexity of the problem," he said.

BRIDGES MENTIONED coal a few times in his fast-paced, wide-ranging talk about several sources of energy.

He said that if energy consumption in the United States continued its current rate of increase until the year 2000, the amount of coal strip mined in the United States today would triple to keep up with it.

Bridges remarked that the amount of water available would be a critical factor in development of energy plants using coal, especially gasification plants and mine-mouth generating units.

Current commitments to construction of more electric power plants, he said, will result in the United States having in the early 1980s about five times the generating capacity of only 10 to 15 years ago.

BRIDGES EMPHASIZED the wastefulness of the systems used to turn various natural fuels into energy. About 50 per cent efficiency in all the energy-production systems of

the country is the maximum, he said.

"By this year it looks like we're about 52 per cent loss, 48 per cent useful," he remarked.

The speaker, a former electrical and petroleum engineer, said the Atomic Energy Commission is now under a congressional mandate to investigate non-nuclear sources of energy. Bridges commented, however, that in projections of energy that will be consumed up to the year 2000, the amount that would come from such sources as solar, geothermal and wind power is insignificant.

BRIDGES SAID his briefings of congressmen are intended to make them think about whether the U.S. should, or naturally will, continue the current rate of energy consumption. Planning is vital, he said, whether for increasing fuel imports or for reducing national energy consumption.

Bridges remarked that his talk in Billings was beyond his routine work and was "because of the muscle of Mike Mansfield (Senate majority leader)."

"This is briefing No. 137 in the past three months, but it is only the 21st or the 22nd one outside the Capitol," he said. About 55 people heard him speak at Eastern Montana College.

BRIDGES SAID he believed there were three stages of awareness of an energy crisis. The first was that it was developing. The second was "finding a scapegoat," with oil companies and environmentalists blaming each other.

"We hope the third stage will show up pretty fast, and that is that we do have a problem — and then settle down to do something about it," Bridges said.

Lower standards urged for coal-fed power plants

By MICHAEL WENNINGER
Gazette Staff Writer

Lowering federal and state environmental standards to accommodate coal-burning power plants is urged in a report issued by an organization representing the electric utility industry, including private, public and government systems.

Earlier this month there were news stories that federal agencies would propose that the Nixon Administration relax some air-pollution control standards to permit coal burning that otherwise would be illegal.

THE RISK of having many electric-power generating plants in the United States dependent on imported oil was cited as the reason why there should be more power plants fueled from the country's massive coal reserves.

Huge coal-fueled plants are being built in Montana and Wyoming by utility companies that contend they are needed to prevent a shortage of electric power.

The stand of the operators of power systems in the U.S. is spelled out in the report issued by the National Electric Reliability Council.

They urge relaxation of federal and state air pollution standards until pollution-control technology is improved.

They also oppose some laws intended to prevent excessive heating of streams by power plants using water for cooling.

THE NATIONAL Electric Reliability Council (NERC), formed in 1968, represents the country's major electric utility companies and cooperatives and also federal government agencies such as the Bureau of Reclamation, which wholesales power from its hydroelectric dams.

Members of the council's executive board include Harold Aldrich, director of the Bureau of Reclamation's regional office in Billings.

The council's report was compiled last fall and a copy was provided this week to The Gazette by Martin Oleson Jr., the bureau's assistant regional director.

The report is titled "Review of Overall Adequacy and Reliability of the North American Bulk Power Systems."

OLESON COMMENTED, "This year's report assesses the anticipated near-term (1972-74) and longer-term (1975-81) electric power supply situation. It also highlights the evolving factors which bear upon the electric utility industry's ability to meet the demands for electric power during this decade.

"The National Electric Reliability Council consists of nine regional reliability councils and encompasses essentially all of the power systems, investor-owned and publicly owned, of the United States and interconnecting systems in portions of Canada," Oleson said.

In the language of the report, the country has "unrealistically stringent air pollution standards" and "excessively stringent emission standards."

THE REPORT'S conclusions include:

—"To meet the nation's need for electric energy, it is imperative that some accommodation be made in federal and state air pollution standards being promulgated for the initial compliance date of July 1, 1975, until technology is developed on a reliable and demonstrated basis either to remove sulfur dioxide from flue gas (power plant emissions) or to remove sulfur from coal.

"Without such an accommodation, which will allow the use of the nation's fossil-fuel resources, today's dilemma in energy supply will become tomorrow's crisis — a crisis largely man-made."

—"UNREALISTIC thermal discharge standards (for streams) being promulgated in certain areas of the U.S. preclude the construction of generating plants on any established technical basis. Should such standards prevail, the adequacy of power supply in those areas will be seriously compromised."

The NERC report emphasizes that electric service should be reliable, free of sudden and widespread interruptions. Con-

cern is expressed about "the growing de-emphasis on reliability by governmental officials and environmental organizations. The inference is that reliability should be compromised to secure environmental objectives."

Elsewhere in the report is this comment:

"IT IS unacceptable, if not dangerous, to talk of reducing the demand for power by creating a scarcity of new generating plants and transmission lines in order to reduce environmental impact.

"Similarly, it is unrealistic to consider restricting the output of existing generating plants for environmental reasons without recognizing the need to bring replacement capacity into operation.

"... A reliable and adequate power supply is essential to the goal of an improved environment."

The position of the National Electric Reliability Council on using coal for power is clear in this comment:

"IT MAY be concluded that the reliability and adequacy of the nation's power supply during the next 10-year period depends primarily on two factors:

"(1) The bringing into service of nuclear generation on a timely basis, and (2) the availability of oil, which of necessity must come from foreign sources.

"Both objectives appear to be subject to hazards."

The report continues, "Therefore, to insure the nation's future energy supply on even a reasonable risk basis requires the continued use of the nation's coal resources for the coal-fired generation (facilities) in operation or projected.

"To achieve this objective in the light of present technology for the removal of sulfur dioxide from flue gases and to allow time for developing and implementing such technology will require the reconsideration of the excessively stringent emission standards and revision of the associated compliance programs now being promulgated."

Mining expansion

By GEORGANNE LOUIS
Gazette Staff Writer

Expanded strip mining in Montana is inevitable, speakers at Eastern Montana College said Tuesday night.

The speakers were part of a three-hour session on strip mining and the energy crisis, sponsored by the Billings Environ-

mental Communications Council.

John Goers, administrator of the reclamation division of the state lands department, said the coal will be mined because the national consumption of energy cannot be slowed down.

GOERS DISCUSSED reclamation requirements and coal

company response in Montana, but said reclamation is not the real problem.

He said the real challenge would be dealing with the influx of people and pollution.

"If my constituency were national and I had to consider the pollution in Chicago and Newark from the vantage point of Washington, D. C., southeastern Montana would seem a pretty empty place."

Goers said the four major coal companies in Montana were not covered under the last legislature's reclamation bill.

WHILE COAL companies now must have contracts with the state detailing reclamation standards, the four are under older laws and have voluntary commitments on reclamation.

But he said the Knife River Coal Co., a subsidiary of Montana-Dakota Utilities, and Decker Coal Co. have voluntarily applied for state contracts.

The Western Energy Co. is considering a contract while the Peabody Coal Co. "seems quite hesitant," Goers said.

A SECOND panelist, Edwin "Moose" Zaidlicz, state director for the federal Bureau of Land Management, told the 100-member audience that there are 770,000 acres of strippable land in Montana.

Cecil Garland, president of the Montana Wilderness Association, asked if the coal companies would be satisfied when they have stripped the "strippable" area, but he didn't get an answer.

Garland had been scheduled to speak but the Council earlier dropped him from the list for time reasons.

He also wanted to know if subsurface and surface rights to land could be reunited so land couldn't be sold with mineral rights going to one owner and the surface land to another.

A third panelist, Paul Long, public affairs manager for Humble Oil Co., objected to such a union retroactively, but favored such a law which would require such union in the future.

THE MOST serious part of the energy crisis, Long said, is that "70 per cent of the oil reserves in the world are in the Middle East (countries) which are not leaning our way" (to America).

The final panelist was Tom Gwynn, chief geologist for MDU and manager of reclamation and conservation for the Knife River Coal Co.

Gwynn said strip mining has some distinct advantages in that it is four times safer than underground mining, up to 95 per cent of the coal is recoverable compared to 50 per cent with underground mining, and reclamation is easier with strip mining.

He also said a responsible coal company would be reclaiming more land than it is strip mining.

'inevitable'

Atomic energy dream pierced

By RONALD J. SCHLEYER
Gazette Staff Writer

The dream that atomic energy will quench America's thirst for energy may be only a mirage at the end of the energy-crisis tunnel, a Wyoming professor says.

Edward J. Hoffman, until recently an associate research professor for his state's Natural Resources Research Institute, told an Eastern Montana College audience that the complete facts on atomic energy are hidden.

"Just about as much energy proportionately goes into mining, concentration and enrichment of the (nuclear) fuel as is ultimately realized from the use of nuclear power," Hoffman

told the audience of about 75.

NUCLEAR FUEL does not come ready-to-use from the earth, Hoffman explained. It must be concentrated, with massive amounts of electricity, in gaseous diffusion plants, one of which is planned for Montana because of its coal reserves.

Hoffman was compiling information on over-all efficiencies of various power sources, among them atomic energy, when he discovered no such determination has ever been made for nuclear power due to government secrecy, he said.

Even fusion power, predicted to someday provide limitless energy, may be dependent on a

finite resource—lithium, Hoffman said.

A complete look at coal reserves, Hoffman said, shows how pitifully small they are with respect to current energy demand: depletion of U.S. oil supplies would occur in 13 years, natural gas in 25 years.

"MERELY TO bridge the gap between production (of gas) and discoveries would require that nearly 100 coal gassification plants be in existence and operating now," he said, and it may be 10 years before a proven gassification process is developed.

Completely converted to gas and oil in factories that have not been designed yet, Hoffman said, U.S. stippable reserves of

coal would last 10 years in replacing current use of these materials.

"Since World War II we have been led to believe that there is no need to conserve fossil fuels, that science and nuclear energy will take care of the problem," Hoffman said.

THE FACTS of efficiency of production show, however, there is no permanent solution to the energy problem without a reduction in the burgeoning demand, he said.

Intensive research and a massive federal plan for energy use is needed desperately, he said, citing these possibilities for exploration:

- Using smaller cars and more efficient mass-transportation systems to reduce the demand for oil by half.

- Conversion of sewage, feedlot and other wastes to burnable gas to reduce the demand on natural gas supplies by 30 per cent.

- Increased use of hydroelectric power and exploitation of geothermal, tidal and wind generating systems combined with more efficient production of electricity from coal could save additional amounts, Hoffman said.

"IN OTHER words, perhaps one-half of the total fuel energy load could be saved without impairing the present standard of living," he said.

Eventually, Hoffman said, the U.S. should plan on using only as much energy as is available from solar power.

Utilizing five per cent of the land surface at one per cent efficiency would liberate nearly as much energy as is being consumed through use of non-renewable fossil and nuclear fuels, he said.

Ecology-growth balance is urged

By MICHAEL WENNINGER
Gazette Staff Writer

A balance between protection of Montana's environment and development of the state's economy was urged Monday by Gov. Forrest Anderson.

Speaking in the Northern Hotel to the Billings Rotary Club, Anderson warned of "environmental totalitarians" who would "make Montana a museum—locked up, depopulated and

mummified in its own stagnant economy."

Anderson said the balance he seeks was the reason for his refusal last winter to sign the air-quality implementation plan approved by the Montana Board of Health.

"**THE SULFUR** oxide emission-control standards proposed by the board of health were the most stringent in the nation," Anderson said. "They exceeded

federal standards and they were higher than the recommended levels in our neighboring states. And I must point out that the sulfur oxide standards were the only sections of the plan to which I objected.

"At the time the implementation plan was forwarded to me by the board of health, there were 23,000 people out of work in this state. Our rate of insured unemployment was the third highest in the nation," he said.

"We faced the prospect of losing 5,000 jobs in the forest products industry. And announcement of the closure of the zinc-smelting operations in the state threatened the loss of an additional 800 jobs," the governor said.

"**THE MOST** stringent air-quality standards in the nation and the possibility of forced curtailments in one of the state's basic industries could not be justified in consideration of the bleak economic situation that prevailed in this state last winter.

"The proposed standards were not in balance with the economic needs of Montana."

The proposed sulfur-oxide emission standards would have affected mainly the plants of

Anaconda Co. and American Smelting & Refining Co.

Anderson remarked. "I did not believe the security and welfare of hundreds of people in Anaconda, East Helena and Great Falls should be sacrificed to attain an arbitrary and questionable air-quality standard."

HE ADDED that the stringent regulations "would have made it impossible for Montana to reach agreement with other states on a comprehensive and reasonable pollution-control program."

The governor summarized his attitude with the comment that "theories and experiments should never be more important than people."

"I completely recognize and support the necessity to preserve the quality of Montana's environment," he said.

"But environmentalism, like any movement, can be carried too far. At the extreme, environmentalism is an elitist cause with an insolent disregard for the social and economic conditions that affect most people.

"**THERE ARE** environmental totalitarians who would impose any economic stricture on Montanans to preserve their selfish interests in this state. There are outsiders who would like to make Montana a museum—locked up, depopulated and mummified in its own stagnant economy."

Smog comes to Decker

It was interesting to read about the Decker Coal Mine from Chicago's point of view ("Land of the Monsters" by Bob Wiedrich).

Anyone who has ever been within 50 miles of Chicago can sympathize with Chicagoans' fervent wish to see their air cleaned up.

However I think it is fatuous in the extreme to think that mining this coal will make Chicago skies "As clear someday as those that embrace the peaks of the Big Horn Mountains of the Far West."

On the contrary, what it will accomplish — and is already accomplishing — is a devastating pollution of these hitherto clean, pure skies.

I went on a shopping trip to Sheridan yesterday from our ranch north of Decker; on the trip to town I was rather shocked to see heavy smog hanging over the Decker Basin and the Tongue River Reservoir, dirtying the snow and obscuring the view of the Big Horns on a day which was so clear and sparkling that the mountains should have stood out sharply against a deep blue sky.

But coming home was worse; I might have been heading for Gary, Ind. (close neighbor to Chicago), instead of Decker, Mont.

A black pall so thick a person couldn't see the sky at all hung over the entire basin, and what really frightening to me was the

fact that this pall extended north and east, settling heavily and ominously along the Tongue River Valley and up creeks as far as Birney, which is a good thirty miles. No longer was the sky blue right down to the horizon.

I had thought previously that power plants were, if not the only, at least the worst, threat to the air of Montana. Now I see that strip mining itself could be the ruin of the Big Sky.

Perhaps Mr. Wiedrich will see (though I doubt it) the Chicago skies become Montana-pure; but it will be at the cost of seeing Montana skies become Chicago-filthy.

M. H. Cochran
Decker

Coal called important 'interim' energy

By AL DARR
Butte Standard Sunday Editor

Montana's low-sulfur coal deposits in the Yellowstone River drainage will serve only as an interim energy source, say two Butte men who should know.

At the same time, strip mining east of Billings will disturb a maximum of 128,000 acres, not a million acres as critics of the Colstrip project have forecast.

Dr. Sidney Groff, director of the Montana Bureau of Mines, has with his colleagues been doing coal research at the bureau since 1965, assisted by state and federal grants totaling \$750,000.

"I said they would have hydrogen fusion licked in 50 years," Groff said last week. "I've revised that judgment downward to 30 years. Our basis source of energy by then should be nuclear."

GEORGE O'CONNOR, president of Montana Power Co., goes further.

"I'd say we'll be nuclear in 30 years, and in the last part of the 30-year period we'll be using breeding reactor fission."

Montana, meanwhile, faces a real energy crisis, both Groff and O'Connor declare.

Technological lag has hardened the head-on clash between coal utilization and environmental concern, Groff said, but some of Montana's 33-billion-ton known coal reserve must be used as an interim fuel.

"Think of the deep-freeze situations we've had this winter," Groff said. "If power went out for 24 hours along the Canadian border, imagine what it would do."

Montana electric utilities peak in winter, meaning the likelihood of a brownout or blackout would be strongest in cold weather.

Montana Power Co.'s peak system demand today, O'Connor said, is set under a million kilowatts. The power company must purchase from Bonneville and out-of-state utilities 25 per cent of its peaking power.

"We haven't got as much as a year's grace period in getting the first Colstrip plant on the line," O'Connor said. When

the first 350,000-kilowatt plant goes on the line in 1975, we'll be importing power for Montana industry."

BASED ON A 40-YEAR modest load growth of 5 to 6 per cent, O'Connor estimates the system's 1976 demand for Montana alone will peak at 1.3 million kilowatts.

MPC's purchase power is guaranteed by contracts, but they are short-term contracts, O'Connor said.

Groff emphasized the virtues of eastern Montana low-sulfur coal, which will be mined at an estimated rate of 750 million tons annually by the year 2020, according to a U.S. Bureau of Mines report.

Low-sulfur and low-ash content make the coal desirable as a home energy source and highly marketable as an export to be blended with eastern coals that afford high-BTU output but serious air contaminants as well.

Groff said the people impact on Montana will be modest.

"We don't anticipate large scale industry," he said. "I see an influx of maybe 50,000 people, none west of Billings."

He mentioned the possibility of a specialized stainless steel plant into eastern Montana, "not far removed from Butte."

As for land spoilation, Groff says the Colstrip operation can turn affected acres into a high-value multiple use area.

Water will be a problem, Groff said, although the demand will be only half the volume he first forecast, if his present estimates prove accurate.

Groff looks now for a maximum demand at Colstrip of 1.8 million acre feet a year, drawn directly from the Yellowstone drainage. Colstrip lies 30 miles south of Forsyth, 1000 miles east of Billings. Rosebud Creek is the tributary drainage.

BY COMPARISON, Montana dumps annually on the average 16.7 million acre feet of water from the Yellowstone-Missouri complex into North Dakota.

"If we could catch and hold the June floods, the water problem would be significantly eased," Groff said. "By the end October, the river runs pretty low."

He said Montana Bureau of Mines has never recommend-

ed large-scale utilization of groundwater. The so-called Fort Union formation, he said, won't stand up to taking thousands of gallons per minute unless the wells are drilled thousands of feet deep.

But Groff said Montana faces a far greater threat to its agricultural land than strip mining.

The state, he said, is losing 25,000 acres a year to a saline seep problem north of the Missouri River.

Groundwater may kill the soil forever, Groff said. Groundwater near the surface carries the deadly chemical. Plant life won't survive in severely infected soil.

Groff insists that environmentalists make a great mistake in targeting utilities and attempting to reduce electrical energy output.

"Electricity is vital to the environmental protection effort itself. Without sufficient energy, technological progress in the field would be impossible."

He said Montana is using its hydroelectric resources almost to their maximum.

"HYDRO POWER is ideal," he said, "but I believe we're down to two potential dam sites yet to be utilized."

O'Connor agrees. He said the proposed Reichle Dam on the Big Hole, for example, would not carry enough water to justify installation of a turbine generator. Yet Reichle north of Dillon would impound more water than any other sector of the Big Hole.

Groff's research on alternate energy sources generally point years ahead, but all show promise. Direct conversion of minerals to kilowatts is one such project in the nation's laboratories. The electron battery may become alternative to internal combustion.

Groff said the nation's critical need is a crash program to advance energy technology.

He said, too, Montana errs if it thinks the energy problem can be locked out of Montana. In six years, he estimates, Montana will become the nation's key mineral supplier, more important than Alaska.

Colberg links litter, electricity

By GARY LANGLEY
Gazette State Bureau

HELENA—Richard A. Colberg, a young representative from Billings with an interest in energy conservation and litter, did some research last week and one thing led to another.

He discovered a direct relationship between the energy crisis and aluminum cans.

As a result, he says: "Recycling is one of the most important things this county is going to have to live up to to solve its energy problems."

Colberg introduced a bill Thursday aimed at requiring a refund value on beverage containers sold in Montana, requiring dealers and distributors to

accept empty beverage containers and providing for the establishment of container redemption centers.

HE ALSO SIGNED a bill last week that would prohibit utility companies from advertising to encourage their customers to use more electricity.

"I feel both are important and both are related," he told the State Bureau.

What Colberg's research uncovered was this: The production of aluminum in Montana consumes a great deal of the state's electricity—Colberg says a third—which makes it the leading consumer of energy in Montana.

The figure disturbs Colberg Co. included.

who, in a State Bureau interview, criticized the aluminum industry for opposing recycling laws and the power industry for spending more money on advertising than research.

"The companies are spending much more money in campaigns against this kind of legislation" than on research, he maintained, and on advertising to urge the consumption of energy and beverage containers.

Colberg said, for example, utilities as a whole spend about a tenth of what other industries pour into research and development while spending six to seven times more on promotional advertising—Montana Power Co. included.

HE SPECIFICALLY accused MPC of "misleading, false advertising," in its campaign to build public support for its proposed steam generating plant at Colstrip.

The ad, placed in newspapers and on television, contends that Montana will face its first brownout by 1975 unless the plant is built.

Meanwhile, says Colberg, alternative forms of energy are available that could be realized if the money spent on that kind of advertising went for research.

"We are going to have to find alternate energy systems and we are going to have to get on to the idea of recycling economies," Colberg said.

Colberg described steam generation as the most inefficient method of consuming coal to produce electricity, while gasification processes, if developed, would be twice as effective. Steam generation has an efficiency rate of 30 per cent, he said, while the efficiency of gasification is 60 per cent.

MEANWHILE, he said:

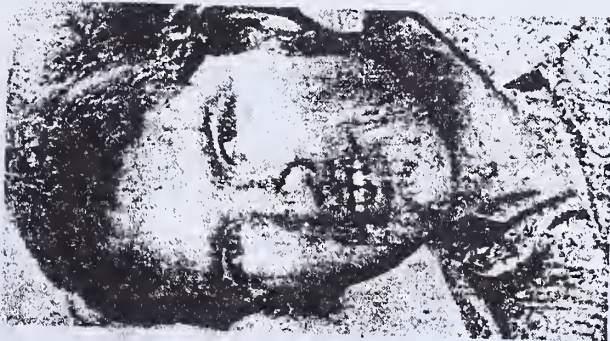
—Russia has developed a coal consumption process that is more effective.

—Techniques have been discovered to gasify solid waste and produce energy just as techniques have been found to gasify coal.

—Energy can be produced, if technology develops, from human and animal wastes.

But in the meantime, Colberg fears the cycle of energy consumption will continue.

"Since the Montana Power Co. is a monopoly which is granted its right to exist by the public it seems insane that they



RICHARD A. COLBERG

for more consumption of energy by a wasteful process to supply wasteful industries at the expense of Montanans who must pay the bill," Colberg said. "We pay the cost of disposal of litter; we pay higher rates for electricity than industry does and we pay Montana Power Co. for their advertising."

The benefits of strip-mining

Your front page editorial, "Death knell for Montana—in Colstrip", was quite impressive, although, after reading it three times I could not find any facts contained in it.

Don't get me wrong. I have as high regard for the natural beauty of Montana and Wyoming, and also clear water and air as anyone. However, I think that all of us should look at these things in a sensible way. Also, it seems like we should first consider the facts, all the facts and benefits as well as the disadvantages.

First of all, when you speak of strip-mining as it is in Montana and Wyoming, and as it is in the Appalachian country of districts strip-mined in the East, you are talking about two entirely different things. In the East, most of the strip-mining is in mountainous or very hilly country where it is almost impossible to reclaim the surface and there is damage to the scenery. In this country, most of all the strip-mining is in flat, or nearly flat, areas.

Next in importance, it seems to me, is the depth of the coal

seams and the amount of overburden. In the East, the coal seams are very shallow compared to ours. Much of the coal there is in seams of less than 40 inches, and they must remove up to 180 feet of overburden to get to it. Here the seams to be mined are from 25 to as much as 200 feet thick with average overburden of from 10 to 25 feet. Thus, there's really no comparison.

Then there are the benefits, as weighed against disadvantages, and particularly against the values of the lands as they are now and benefits which can be derived from reasonable development of these tremendous resources. Estimates shown in the magazine, "Business Week" of Nov. 4, give the total mineable reserves of coal in Wyoming and Montana as in excess of 20 billion tons of low sulfur coal. Figure this out at even \$5 per ton and you get the stupendous total of 100 billion dollars, and that's an awful lot of money. With the state's share, plus the severance tax, plus the property tax, plus taxes from people working there, and plus the Montana

State Income tax in that state, and you have a lot of money coming in.

Balance this against the present income from these same acres, most of which are only grazing land, and poor quality at that! It takes around 30 acres to feed one cow, and the growth of one animal doesn't contribute very much. Mining one acre of this same land, with a 25-foot coal seam, produces 44,000 tons of coal. Thirty acres would produce 1,320,000 tons, which at just one dollar a ton would bring over a million dollars to Montana.

As to the environmental damage, I would like to quote you some figures: Montana is 570 miles long by 315 miles wide, which I figure totals some 179,550 square miles, and even if you take the figure 175,000 square miles, to make it even figures, you have 112,000,000 acres of land. With a reasonable amount of back filling, which the miners are willing to do, the mining could be of tremendous economic value with an infinitesimal amount of damage. A few more hills and valleys created could

injure nothing or anybody.

To go back to the Lewis and Clark days, which some of the rabid environmentalists would like, would require the removal of all the railroads, all the highways, all of the cities and towns. I am pretty sure that none of us would like to have to cut our own wood, hunt our own food, build our own teepees and put up with all of the other inconveniences.

Let's look at these things in a sensible way.

My only reason for making the effort that I am is my regard for the benefits which can and should accrue to Wyoming and Montana. I do not own a nickel's worth of coal properties or any interest in a coal mining venture. We are extremely fortunate in having these millions of dollars worth of resources, which if left in the ground are not worth one cent, but which if properly developed can mean tremendous benefit to our states and our people with no one even slightly injured.

W. B. House
Cody, Wyo.

Researcher opposes ban on all strip mining

By STEVEN P. ROSENFELD
COLSTRIP, Mont. (AP) — A coal-development researcher warned Montana legislators Wednesday against declaring a moratorium on strip mining, saying slow development of the state's massive coal resources should be encouraged instead.

"We should encourage slow development to tame the coal monster," Dick Hodder of the Montana State University agricultural experiment station said.

Hodder has been making reclamation-planning studies for eastern Montana coal developers.

"I think moratoriums are the ostriches that want to stick their heads in sand and let the world go by," he said.

Fifteen state legislators and Lt. Gov.-Elect Bill Christiansen were on a two-day tour of strip mines at Colstrip and Decker, accompanied by Ted Schwinden, state land commissioner, and mining company officials.

Paul Schmechel, vice president and general manager of Western Energy Corp., told the lawmakers that an estimated 850 million tons of minable coal lie in the firm's Colstrip area of operations.

He said the wholly owned subsidiary of Montana Power Co. has contracts to deliver at least 350 million tons of the low-sulphur coal.

Schmechel said strip mining operations currently are yielding 5.5 million tons of coal annually and that in five years the yield will increase to between 11.5 and 13 million tons a year.

That level of mining will eventually disturb 350 acres of grazing land annually, he said.

Joe Lake of Denver, western region director of surface operations for Peabody Coal Co., said his firm currently is mining 1.5 million tons of coal annually. In five years, he said, Peabody will be mining four million tons of coal annually.

Lake, who said coal operations are forecast to run over a 30-year period, reported his firm has current commitments to deliver 100 million tons of coal.

Schwinden noted that in 1969, one million tons of coal were taken in Montana strip-mining operations. This year, the yield is expected to be 10 million tons, and next year it is expected to be between 15 million

and 17 million tons, he said.

Hodder told the legislative coal tour "there is no way anyone can state that reclamation in Montana can be successful."

But he said indications are good that mining techniques can be developed to lead to successful reclamation.

He urged that slow development be allowed to let technicians develop reclamation procedures.

Hodder said different mine equipment, blasting techniques and soil conditions create separate reclamation problems at every strip mine at the state.

"If we introduce mining operations at a slow rate, we can learn how to handle problems as they develop and keep up with them," he said.

Since individual areas present different reclamation problems, Hodder said, the declaration of a moratorium for the purpose of developing effective reclamation procedures would not be meaningful.

Hodder estimated coal companies should be able to reclaim

strip-mined land for \$500 an acre.

Peabody employs 40 miners at its Colstrip diggings while Western Energy currently employs 150, officials said.

Schmechel said Western Energy paid \$1.7 million in

state, federal and local taxes last year on its mining operations.

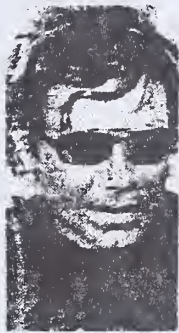
Coal mined in the Colstrip area is owned by the Burlington Northern Railroad and the federal government, mining officials said.

Newby not optimistic on state environment

By RONALD SCHLEYER
Gazette Staff Writer

A key state environmentalist said Tuesday that despite far-reaching laws to be proposed in the 1973 Legislature, he is "not very optimistic about maintaining the environmental quality of the state" without strong federal action.

Montana's environment, threatened from many sides by urban sprawl, suburbanization



SCHLEYER

of mountain valleys and destruction of agriculture, now faces the crucial challenge; coal and water exploitation, said Fletcher Newby of the state Environmental Quality Council (EQC).

As executive secretary of the 12-member group that analyzes information for the legislature, Newby said in the EQC's first annual report: "Montana has only a short time in which to break out of century-long colonial status."

Although it has potential benefits, Newby said of the state's coal resources, "there is a highly significant potential environmental impact."

HE TOLD AUDIENCES of environmentalists, citizens and legislators at Eastern Montana College that coming power generation development "is obviously far-reaching, exceeding anything we have previously known."

In fact, he said, proposed and prospective coal-burning, gasification and gaseous diffusion plants (to produce nuclear fuel) in Montana make it imperative to have laws regulating plant siting.

Because of the potential scope of development, Newby said, the state needs unprecedented and broad authority.

He said EQC will recommend amendments to current strip-mine law to provide for permits

and denial of them "where there are excessive slopes, overriding scenic or archeological values, or where ... adequate reclamation is not possible." Control is needed on mining methods, too, he said.

Even if coal seams less than 30 feet thick are not disturbed, Newby said, some 128,000 acres would need reclaiming.

THERE REMAINS "substantial doubt that disturbed lands can be returned to beneficial use" in Montana, Newby told the legislators.

State Sen. Archie Cochrane, commented "perhaps we could learn as we go on reclamation," and Newby replied that even industry is conducting research in reclamation because so little is known.

Newby warned that selective denial of strip mining permits (under the proposed law) and a strong plant siting law might not prevent environmental harm because federal agencies control 55 per cent of the stripable mineral resources in Montana, Newby said. "Equally strict federal laws must support strong state laws," he added.

The coal problem isn't limited to the Colstrip region, Newby carefully pointed out, due to proposed nuclear and coal-fired generators in Western Montana, 500 miles of transmission lines that consume 20 acres per mile, pipelines and water consumption.

Of second priority is a series of laws to regulate land development, Newby said.

URBAN SPRAWL that now squats on 200,000 Montana acres "continually erodes" the agricultural base that is the heart of Montana, Newby said.

Utilities corridors for power and transportation routes need tighter regulation, he said, together with platting laws that allow subdividing without planning, and highway development with no regard for prime agri-

cultural land.

Potentially devastating, is the little-known problem of "saline seep," the process that pollutes water supplies with brine forming from rainfall on fallow fields in Montana's salty glacial soils.

About 250,000 acres are already affected, he pointed out, with a potential 3 million acres threatened. No complete solution is apparent except to let nature grow grass.

NEWBY SAID the EQC also would recommend:

- An environmental protection act to allow "citizen suits" to protect environmental quality.

- A "disclosure law" to force industry to file information on emitted pollutants.

- Laws to control noise and junked autos.

- Institution of state land use, energy and transportation policies.

Responding to an invitation by Falls Creek Project director Francis Mitchell, who organized Tuesday's sessions, Newby met with representatives of the League of Women Voters, the Environmental Communications Council of Billings and the Northern Plains Resource Council.

IN A GROUP workshop they identified these forces acting against passage of adequate state environmental law:

- Corporation influence and advertising promoting incomplete information on energy needs and a false sense of crisis and urgency.

- Inadequate congressional action, state executive leadership and funding.

- Citizen ignorance, apathy, resistance to regulation and in some cases, an "anti-environmental attitude."

- "Inflexible environmentalists," lack of facts on energy use, demand and availability, and widespread belief that limitless growth is inevitable.



The 20 steps to reclamation

By **DUANE W. BOWLER**
Editor, *The Gazette*

It's pretty well determined that more strip mining is going to take place in Eastern Montana's rich coal fields.

The question still without satisfactory answer is what will be left when the coal miners are through.

This pertains not only to the entire area but also to those portions which fall increasingly under the euphemistic term of being "disturbed."

WE HEAR MUCH talk about the necessity of restoration and reclamation of the land but not too much about what must be done to assure it.

Bulldozing the "disturbed" areas to a rolling terrain, scattering a few seeds and hoping for rain won't do the job. It has to be done right.

A man with much experience in strip mined land reclamation, one who knows the ramifications of the job and has been on the Montana scene, has some recommendations for Montana to follow.

ELMORE C. GRIM of the National Environmental Research Center has 20 recommendations for Montana to follow if it wants successful reclamation in the strip mine areas:

1. Reduce all highwall, perimeters, and roadways to at least a 3 to 1 slope.

2. Grade interior spoils to at least a 5 to 1 slope.

3. Control road location, maintenance, bedding down and length of time they may be kept open before final grading.

4. Keep spoil out of all waterways. Waterways are defined as any channels through or along which water runs.

5. Use "head of hollow fill" for excess spoil. Construct fill according to established guidelines.

6. Do not leave any isolated areas of land surrounded by an inaccessible highwall, road or any other practice that is the result of mining.

7. Leave a buffer zone of undisturbed surface to protect natural, scenic formations.

8. No roads should be surfaced with coal refuse, reject or other toxic materials.

9. Control dust on roads and around processing areas.

10. Extinguish all fires as soon as they are discovered.

11. Bury all reject coal in the bottom of the pit on the low wall sides, cover with clean fill.

12. Bury all gray colored material that is immediately above the coal and between the seams in the bottom of the pit, cover with clean fill.

13. Eliminate all depressions that hold water unless approved by the Division of Reclamation.

14. Save all topsoil and spread on final graded areas at least 6 inches deep. Topsoil is defined as that strata contained in the root zone and will support growth of desirable vegetation. The root zone can be easily recognized by the equipment operator.

15. Ore sample analysis should be required. This will help determine soil placement.

16. Drill all seed. This is the only way to get successful germination. Slope may be a limiting factor in which case broadcasting seed will be allowed.

17. Irrigate new seeding and plantings if necessary to get them established and maintained. No vegetation effort will be successful if grazing is not controlled.

18. Prospecting could become a problem and should be required to have a permit. Guidelines for prospecting should be established similar to those of surface mining.

19. Blasting practices as now carried out are destroying natural, scenic formations, by vibrations. This could become their number one environmental problem if not controlled immediately.

20. In the interest of economy, efficiency and duplication of efforts, it is mandatory that one agency be designated to correlate all activities on surface mining.

Grim adds another not on the formal list of recommendations. Don't let the Bureau of Mines be that agency.

IT ALL GOES BACK to a few basics if Montana is to have anything worthwhile left after the miners are through.

Make your decisions for conservation and don't let them tell you it can't be done.

It costs only pennies per ton of coal removed to do the job right. That isn't asking too much

EPA Report: Western Coal Cheap, Clean

By Darwin Olofson

World-Herald Washington Bureau,
Suite 1217 National Press Building.

The Environmental Protection Agency (EPA) has been taking a long look at the vast reserves of low sulfur coal in Montana and Wyoming as a cheap, "clean" energy source, it was learned Saturday.

Evidence of its interest is in a report prepared under contract for the EPA, a copy of which was obtained by The World-Herald.

The report describes the Western coal as the least costly substitute for "nonacceptable" (high sulfur) coal now being used in the central United States.

"It is physically feasible to increase Western coal production by the 90 million tons (a year) needed in 1975 by central users who are likely to use this alternative," it adds.

The central region of the United States, by its definition, extends from the Canadian border to

Environmental Report:

Western Coal Is Cheap Energy

Continued from Page 1.

Texas and Arkansas and from eastern Nebraska to Ohio.

Coal production in Montana and Wyoming last year totaled only about 17 million tons.

The report states that more than 500 billion tons of low sulfur coal reserves exist in the Rocky Mountain states, then continues:

"At least 15 billion tons are recoverable, at or near current prices, in Montana and Wyoming.

"These reserves, if fully developed and exploited, would be sufficient to support a production rate of perhaps 500 million tons per year."

Shortages

Adding to the study's significance are:

—Reports that President Nixon in a forthcoming energy message may recommend development of low sulfur coal resources.

—Concern over energy shortages, current and long-term.

—The environmental factor which, among other things, involves federal and state clean-air standards.

A strategically placed official told The World-Herald that development of the coal reserves would enhance the energy position of Nebraska and other Northern Great Plains states.

"You would expect industry to look at locations near sources of cheap energy," he added.

According to this official, "all the involved federal agencies have been looking at this (the coal reserves)." There are agencies with responsibilities in the energy and antipollution fields, he said.

Some critical assumptions were made by the private experts who prepared the 50-page report for EPA.

One is that present clean-air standards will not be tightened to the extent that even the low sulfur coal would exceed the limitations.

Limits

"A potential coal user faced with uncertainty

about emission limits would probably not make a long-term commitment for Western coal adequate to induce investments in mining and transportation," the report notes.

Another key assumption is that there will be no new "economically significant restrictions on Western strip-mining."

Much of the Montana and Wyoming coal is near the surface and can be strip-mined, which is less costly than digging vertical mines.

Deep-mined coal from the two states could not compete economically with high-sulfur coal from the central region, even allowing for the cost of emission-control devices required by the latter, according to the report.

It estimates that new Western strip mines could be opened at a capital cost of \$3 or less per annual ton. Such mines also are inexpensive to operate, it points out.

Strip-mining, however, has become a target of environmentalists.

Senate Majority Leader Mike Mansfield of Montana has called for enactment of the "strongest of reclamation laws governing face (strip) mining."

Cheaper

Such a law would impose stringent requirements on mining companies to reclaim the surface of the land that has been strip-mined.

Referring to the coal deposits in the Upper Missouri Basin, Mansfield said recently:

"It is quite apparent that the uncontrolled strip mining of these coal deposits is going to proceed unless some action is taken now and all parties concerned."

The EPA report says the cost of transporting coal from Montana to Chicago, the nearest major market area, would be triple the cost of coal.

But for coal users in the central region, it contends, the use of Western coal still would be cheaper than using coal mined in the central region and employing other methods to conform with clean air standards.



STRIP MINE OPERATION AT COLSTRIP IN "BIG SKY" COUNTRY

Showdown in Montana

Residents of eastern Montana are justifiably proud of their "big sky" country. Its green-brown prairie, dotted by scrub and ponderosa pine, stretches in austere grandeur to a distant horizon. But the stark beauty of this region, into which cattle and sheep ranches comfortably blend, is now being threatened by America's insatiable appetite for energy.

The reason is coal. Beneath the prairie sod of Montana and the neighboring areas of Wyoming and North Dakota lie an estimated 1.3 trillion tons of coal and lignite—40% of the U.S.'s reserves, enough to power American industry and heat American homes for decades. Moreover, since the Western coal contains little sulfur or sodium, it will produce relatively little air pollution when it is burned. This is especially important in cities with strict air-quality laws at a time when other clean fuels (natural gas and oil with low sulfur content) are becoming increasingly scarce and expensive. Best of all, the thick coal seams are close to the land's surface and can be easily reached by ponderous machines that peel back the prairie and gouge out the underlying coal.

Such surface mining is so mechanized, however, that it would provide few new jobs for Montanans. The state is therefore considering ways to reap greater benefits from the coal in the form of economic diversification, greater tax revenues and new jobs. The coal could be converted into natural gas at huge plants near the mining areas. Or it might be used to fuel a complex of 21

giant electric power plants in Montana, as recommended by the U.S. Bureau of Reclamation and some three dozen electric utilities. Then the electricity would be sent on long transmission lines to power-hungry cities on the West Coast and in the Midwest.

The Montanans also insist that industry pay the costs of remedying the environmental damage done by mining and processing the coal. Last year a special Montana task force reported that by the time the state's coal deposits are exhausted, some 800,000 acres of Montana—an area larger than Rhode Island—would be chewed up and perhaps even made useless.

If the coal-gasification and power-plant complexes were built, the report noted, more serious problems would arise. The new jobs created by industrialization would swell the state's population from its present 700,000 to more than 1,000,000, causing a need for more services and more taxes to pay for them. Since the best antipollution devices available cannot filter out all the fine particles that go up the stacks or out the water-discharge pipes of new plants, there would also be more pollution.

Despite the gloomy report, says Ted Schwinden, commissioner of state lands, "many people feel that the coal will inevitably be developed." To control that development, the state legislature recently enacted one law to govern the location of power plants and another that requires coal companies to restore stripped land to its "approximate original contour and use." Industry's objections were relatively muted.

In the little town of Colstrip, a coal-

mining electric utility, Western Electric is operating an eleven-acre test reclamation project at a working mine. The company has regraded the land and planted trees and several species of grass for a total cost of \$700 an acre, which adds only pennies per ton to the total cost of obtaining coal. But local farmers and ranchers are not convinced, because reclamation is extremely difficult in the semiarid region (average rainfall: 14 in. per year). "If I used as much fertilizer as they did on that test site," says Rancher Wally McRae, "I could grow grass on the roof of my house."

What most bothers thoughtful Montanans is the lack of definitive information about the long-term effects of development. "We still don't know enough about such things as what will happen to rivers and underground water supplies, about air pollution and population disruption," says State Representative Dorothy Bradley. But the legislature recently voted down her bill setting a 2½-year moratorium to study these problems before coal mining begins on a massive scale. Thus there seem to be radical changes in the future of the big sky country, highlighting a dilemma that will become increasingly familiar as the natural resources of the U.S. become scarcer: Should the residents of one region of the nation be asked to give up their land and traditions for the good of other Americans living hundreds of miles away?

The Tree Rustlers

In McHenry, Ill., a gentleman farmer reported that at least four had been stolen. A Monticello, Ill., landowner found that 20 had been taken from her property overnight. In Columbus, Ohio, citizens discovered that five were missing from a city park. The objects that are becoming increasingly attractive to Midwestern thieves are not the underworld's usual stock in trade. They are black walnut trees, which are disappearing at an alarming rate from the north-central forests of the U.S., where most of them grow. In many places where the best of the giant shade trees once stood, beautifying landscapes in Ohio, Indiana, Illinois and Iowa, there are now only ugly stumps.

The lustrous, easily worked hardwood of black walnut trees is prized by furniture manufacturers the world over, mainly because it can be made into a thin veneer to cover less expensive woods. But the supply is short. Every year woodsmen in the U.S. cut about 11 million more board feet than mature in state and commercial nurseries. As a result, logs from a large, top-quality black walnut tree can fetch as much as \$15,000 nowadays—obviously well worth a midnight foray by tree rustlers.

The wily culprits cruise around wooded areas in cars (one gang uses an airplane) during daylight hours to spot their victims, then strike at night.

Coal rush—A boom or a last stand?

By PETER J. BERNSTEIN
(C) Newhouse News Service

LITTLE BIGHORN — Beyond the grassy knoll where Custer made his last stand, a feverish rush for coal is on, marking a new stage in the development of the west.

The scramble is for coal leases and prospecting rights on the arid plains and rocky buttes for hundreds of miles around —much of it in federal ownership, or in government land grants to the Crow and Northern Cheyenne Indian Tribes and the railroads.

For this is being called the richest coal basin in the world, opening up to strip mining an enormous and virtually untapped reserve of cheap western fuel.

According to government geologists, the basin contains more than 30 billion tons of strippable coal in seams stretching across portions of five states—Montana, Wyoming, Colorado, and North and South Dakota, as well as Saskatchewan in Canada. Only the Custer Battlefield, because of its status as a national monument, is off-limits to the coal strippers.

IN SOUTHEASTERN MONTANA alone, strip-mine production is expected to tear up 770,000 acres of rolling prairie—an area greater than New York City and Chicago combined.

The coal is low in sulfur—a bonanza to electric utilities caught between soaring power demand and new air pollution regulations that forbid the burning of sulfur-contaminated fuel. Consequently, Montana coal is being hauled by rail as far away as Tennessee and Texas.

In trying to satisfy the nation's insatiable demand for energy, however, massive strip mining—and the inevitable environmental and social changes it brings—is threatening to produce an upheaval comparable to the drastic change that occurred one hundred years ago when buffalos were eliminated and Indians corralled on reservations.

"We're threatened with the end of a way of life," says rancher Don Bailey, whose cattle herds are jolted by explosions from a huge strip mine operated by the Peabody Coal Co., the country's biggest.

A rebellion is simmering among hundreds of ranchers



—BN photo

Coal train to Illinois

Low-sulphur sub-bituminous coal is moving by Burlington Northern trains of 100 cars or more from the new Decker Coal Co. mine in southern Big Horn county to Commonwealth Edison power plants at Havanna, Ill. A new 17-mile rail line from east of Sheridan, Wyo. to the mine at Decker, carries the coal trains to BN main line. Decker has a contract with

Commonwealth Edison for 22 million tons of coal and is readying a 41-cubic-yard dragline with a 285-foot boom to remove overburden covering the thick seam of coal. Presently three trains weekly are moving from the mine, loading at a rate of 5,000 tons an hour from two 13,000-ton silos and using a 100-car loop track for continuous train movement.

THE COLLISION between the nation's concern for its environment and the power requirements of its way of life is shaping up in Big Horn County, the heart of Montana's ranching country. There Peabody Coal's Big Sky Mine—"Power for Progress" is its motto—strips 30,000 tons of coal a week for shipment by rail eastward to the Minnesota Power and Light Co.

like Bailey who own the surface rights to 80 per cent of the land in the region, but don't own the coal below. The coal belongs to the federal government or to the railroads which lease it to coal companies like Peabody, a subsidiary of Kennecott Copper Corp.

"Without any controls this is going to be the biggest rip-off in history," says Alec Hansen, executive assistant to Montana Gov. Forrest H. Anderson. "Outside interests are coming in and exploiting our resources, leaving gaping holes and mutilated hills and discouraged people."

At the town of Colstrip (appropriately named) three miles away, vast spoil heaps cover prairie that was once the unfenced domain of cattle ranchers. Giant green-and-yellow shovels, rearing against the sky like prehistoric monsters, gobble rock from the earth, 20 cubic yards at a gulp, 24 hours a day, seven days a week.

The mine, owned by Western Energy, a subsidiary of Montana Power Co., operates like clockwork, at roughly an eighth the cost of an underground mine in Appalachia. Coal from the 24-foot seam is loaded into giant 120-ton trucks which dump it into a tippie where, after being broken into pieces an inch or two in diameter, the coal is automatically loaded aboard 100-car trains for shipment to the Commonwealth Edison Co. in Chicago, among other utilities.

Soon the coal will be going to a 700-megawatt generating station that Montana Power is building at the mouth of the

mine. Another power station is under construction nearby, one of seven such generating plants expected to be built in southeastern Montana within the decade.

Altogether, the Interior Department's Bureau of Reclamation, in a recent study done in conjunction with 35 utilities, forecast the construction of power plants with an installed capacity of 53,000 megawatts along a corridor between Colstrip and Gillette, Wyo.

That vast output—which would travel along high-voltage lines to light homes in 13 states as far away as St. Louis—amounts to 15 per cent of the existing electric production in the United States, or five times the projected output of the mammoth four corners Power Complex at Farmington, N.M.

BY 1980 this will be the largest mine in the world," says Colstrip Superintendent Spec Willis.

His confidence stems from the mine's extraordinary safety record and its precision automation. Working in three shifts around the clock, 140 mine employees have stripped more than 10 million tons of coal since 1969 without a major injury.

This week Westmoreland Resources, Inc., a two-year-old western strip-mining company, contracted to provide eastern utilities with 76.5 million tons of coal over the next 20 years from mineral deposits purchased from the Crow Indian Reservation. And Peabody is scheduled to begin mining soon on the adjacent Northern Cheyenne Reservation, where it purchased coal rights.

So far mining interests have just scratched the surface. Montana's low-sulfur reserve, alone, is four times West Virginia's and Kentucky's put together.

In two weeks, the Tennessee Valley Authority, the biggest user of coal in the country, is expected to award a major long-term contract for low-sulfur coal to fire its steam-gener-

ating plants. More than half of the 30 coal companies that submitted bids are in the Montana-Wyoming area.

For all the profit this extensive strip mining yields, it has raised serious questions among both state and federal officials. Interior Secretary Rogers Morton has agreed to launch a major study of the ultimate impact—economic, environmental as well as social—that coal development will have on the region. A Montana task force is already well into a similar study of its own.

"**THE QUESTION** is not development versus non development," the Montana Environmental Quality Council said in a recent report. "Instead, it is a question of whether or not the coal will be developed in a thoughtful, orderly manner."

What that entails, in effect, is reclamation of the land for productive use—in this case, continued ranching. Whether or not the semi-arid land can be reclaimed remains an open question.

At Colstrip, thistles and native grasses are being grown atop regraded spoil banks, but company officials concede it will take large quantities of water and fertilizer to keep the flora alive. Just how they plan to accomplish this has yet to be resolved, since high reclamation costs could make the mining uneconomical.

In the meantime, Montana's Environmental Council is seeking authority from the state legislature to adopt stringent controls on strip mining, similar to those in states like Pennsylvania and Illinois. For example, it wants to ban mining on steep slopes, places of archaeological and scenic value, and areas where adequate reclamation is not possible.

"We need authority to tell a company where it can't strip mine," says Council Director Fletcher Newby. "Otherwise we have no control over Montana's future."

Though Montana's coal output is increasing by at least 25 per cent a year—it's expected to reach a record 20 million tons by 1975—it still has only four state employees to oversee reclamation.

NOT ONLY MUST they prevent coal fields from turning into lunar landscapes, but they are also responsible for enforcing the reclamation of all other mine sites, including copper, gold, bentonite, and hundreds of sand and gravel pits. And they are responsible as well for overseeing mining in Custer National Forest and other federal lands in Montana.

The policing task is next to impossible. "We know there are a lot of companies operating in violation of the law but we just don't have time to run them down," says State Reclamation Chief Ted Schwinden.

Yet despite the power of the coal companies and the nation's growing demand for what they mine, Schwinden is confident that Montana—unlike West Virginia and Kentucky—will prevent irresponsible strip mining.

"Montana has the last of what is best—mountain streams and an untouched landscape, and we're not going to let anyone destroy them to supply power for elevators to run in Chicago or New York City," he said.

If the state lives up to its avowed intentions, it will have gone a long way toward reconciling the nation's power needs with its ecological imperatives. Otherwise, it could turn out to be Montana's Last Stand.

Oil-to-Coal Shift Urged For Power

By JOHN FIALKA
Star-News Staff Writer

A plan calling for the conversion of a large segment of the nation's electric power producing plants from oil-fired to coal-fired generating units is likely to be part of the President's forthcoming message on energy.

Proponents of the plan have reportedly convinced high Nixon administration officials that relying on the nation's massive coal reserves over the next 15 years to meet the growing shortage will best overcome two major risks posed by increased use of imported oil: the inflationary impact of increasing the nation's balance of payments deficit; and the foreign powers for substantial energy needs.

The President, according to a variety of industry and government sources, is likely to call for incentives that would attract capital investment to revive two major ailing industries: coal mining and the railroads.

Stopgap Measure

The energy message is to be delivered within the next few weeks, according to administration sources.

It is likely to meet with some opposition from environmentalists, however, because relaxation of air pollution controls will be required to permit coal burning on a larger scale. The plan will also spur the demand for more strip mining, a process which environmental groups are busy trying to outlaw.

Coal, according to the strategy, will fill the gap between now and 1985 when improved technology for atomic power plants, plants for converting coal to gas at the minesite and other processes now on the drawing boards, will be ready for commercial use.

There are, reportedly, sever-

al coal use plans under consideration. One of them was just finished by the President's Office of Emergency Preparedness and will soon be printed for official release.

The plan notes that "selective and temporary relaxation" of some state air pollution control standards to permit coal burning could result in a savings of 2.2 million barrels of oil a day that would otherwise be imported by 1980, an annual import savings of \$2.7 billion.

'Feasible' Alternative

In a statement accompanying the report, the OEP insists that it represents no official position but is meant to be "thought provoking."

Relying on the nation's estimated 400 years of known coal reserves, it states, is the "only feasible" alternative to oil in the near future.

By using coal in all existing power plants equipped to burn it and requiring new non-atomic plants built after 1977 to have a coal burning capacity, the proportion of the nation's fossil-fueled (oil gas or coal-powered) steam generating units that use coal could be

increased from a current 55 percent to 75 percent by 1985.

Reliance on coal might be necessary longer than that, the report adds, because "projections of the rate of nuclear power availability have already slipped compared to earlier estimates and might slip still further."

The study, directed by the OEP with assistance from the Departments of Commerce and Interior as well as the Environmental Protection Agency and the Federal Power Commission, notes that about half of the nation's power plants that have the ability to burn either coal or some other fuel are now burning oil or gas because air pollution controls "have now made oil and gas more attractive, even at higher costs."

It points out that some utility regulations that permit companies to pass on the higher fuel costs to consumers could be "modified" to permit the companies to pass on the cost of "scrubbers," or devices that remove sulfur oxides and ash from coal.

Secondary standards called for under state implementation plans now being prepared to meet the federal Clean Air Act of 1970 could be delayed, the study suggests, while the government offers "appropriate incentives" for utilities to install such control devices.

The 1970 law calls for states to establish two sets of standards. "Primary" standards are designed to protect public health. "Secondary" standards, generally tougher, are designed to prevent deterioration of masonry buildings, paint, automobile tires, clothing and farm crops.

The plan, it states, is "critically dependent upon success in reversing the current decline of the coal industry and related industries, particularly transportation."

"Coal mines have been closing at an alarming rate of one or two a week in recent months. High-sulfur coal regions are hard hit. Many new mines are not being opened as planned, largely because of investor uncertainty about government policy."

In order to move the coal, the government may have to find ways to attract as much as \$36 billion in new investment money into the nation's sagging railroad system, the report says, adding:

"Many railroads are in serious financial trouble, eastern roads are rapidly deteriorating, skilled shop labor is not being replaced, and hopper car production lines are being closed or converted to other types of rolling stock."

Asked about the plan, one government source said "If we're going to attract all this money into coal and related things, we are going to have to act now, make a major commitment."

Another added, "As you might imagine, this plan is more politically saleable than importing more oil or buying, for instance, gas from Russia. In addition, developing a dual capability to burn either gas or oil to generate electricity gives us considerable leverage to use with oil producing countries to encourage them to keep the price down."

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As Director of Environmental Engineering for VTN, Dr. Epley is responsible for insuring quality and integrity in all environmental assessments, environmental impact statements, and environmental research projects undertaken by the firm. His duties require the coordination and integration of efforts of a wide range of professionals, including biologists, meteorologists, sociologists, economists, physicists, archaeologists, and various engineering disciplines to insure comprehensive objectivity in completed statements. Further, his activities include coordination with federal, state, and local agencies, meeting with environmental groups and other concerned citizens, and making presentations and giving testimony on behalf of the client at public hearings.

Dr. Epley has a strong background in working with federal and state agencies on environmental and engineering projects. He is familiar with a wide variety of federal funding programs and impact statement requirements, and has assisted clients in obtaining federal, state, and local project financing through program identification, application preparation, and environmental impact statement preparation. Demonstrated recognition of his expertise is his selection to develop a new course for the Environmental Engineering Department at the University of Southern California that will discuss the preparation, processing, and evaluation of Environmental Assessments and Statements. This new program, funded by a Grant from the Federal Government, is recorded on videotape and transmitted live via closed circuit television to various industrial complexes throughout the Southern California area.

Prior to joining VTN, Dr. Epley was senior ecologist for the U.S. Naval Environmental Protection Data Base Office at Port Hueneme, California. He was project engineer responsible for methods and techniques, instruments and instrument systems, and instrument adaptation for the Navy Environmental Data Collection Effort. His responsibilities included the design and coordination of the Navy's Biological Survey of Pearl Harbor contracted to the Applied Biology Group of the NAVAL UNDERSEA CENTER HAWAII LABORATORY. The summary report for the First Survey Cycle was completed in August, 1972. Dr. Epley's duties also included instrument acquisition and evaluation as well as method selection and adaptation for the Navy's Pearl Harbor Laboratory Chemical and Physical Data Collection Effort. After lengthy dialogue with the EPA and Army Corps of Engineers to secure necessary permits, Dr. Epley wrote the specifications and negotiated the contract with the U.S. Naval Oceanographic Office for the Dredge Spoil Study being conducted at Mayport, Florida.

Earlier, Dr. Epley was Environmental Consultant to the City of Los Angeles Department of Public Works. He conducted a study of the Department's effects on the environment and his report together with recommendations was adopted and implemented by the Board of Public Works. He prepared environmental

PAUL J. EPLEY, Ph.D. (Continued)

impact studies for the City on proposed storm drain projects, street widening projects and heliports. He testified before the Council on the environmental effects of proposed ordinances to ban the sale of DDT and other chlorinated hydrocarbons and prohibit the sale of phosphate containing detergents.

Dr. Epley's eight years of teaching experience include the University of Southern California, California State College at Dominguez Hills, and Cerritos College. He currently holds the rank of visiting Professor at Dominguez Hills where he has taught Ecology for the past two years.

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As Senior Ecologist of the Environmental Sciences Department at VTN, Dr. Hemington integrates technical input from experts in all disciplines of the biological, physical, and social sciences to insure that all environmental assessments, reports and research projects undertaken by the firm address themselves to the total ecosystem. His activities facilitate the utilization of environmental disclosures in the planning process. His diverse background and experience in problem definition, data collection methodology, analysis and report writing, as demonstrated by his numerous publications, lends itself to the broad spectrum of projects undertaken by VTN.

Dr. Hemington has a strong background in both field and laboratory investigations. His study relating oxygen consumption to zinc-65 excretion represented a major breakthrough in the use of radioisotopes in ecological studies. More recently, Dr. Hemington has distinguished himself in the field of biochemistry, biochemistry methodology and biochemistry instrumentation.

Prior to joining VTN, Dr. Hemington distinguished himself as a researcher and teacher. His experience includes studies for the University of California at Los Angeles, Laboratory of Nuclear Medicine and Radiation Biology, in the area of rodent ecology. He has taught courses in Cellular and General Physiology, General Biology, Embryology, Mammalogy and Ecology at the University of Southern California. Earlier he was associated with the Los Angeles County Museum Department of Mammalogy.

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As Chief Technical Writer for VTN, Mrs. Skinner is responsible for editing proposals and research reports for Architecture, Engineering, Planning and other divisions. She also assists in the preparation of environmental impact statements for the Environmental Sciences Division. In addition, Mrs. Skinner performs research and analysis in support of the various divisions.

Formerly, she worked as a graduate assistant to the History & Geography Departments of California State University, Fullerton, specializing in both qualitative and quantitative research in the areas of environmental and resources management.

As a Professional Associate to Space Use Management, Fullerton, California, Mrs. Skinner was responsible for activities in urban planning, space use planning, environmental impact studies, and historic restoration. In addition, Mrs. Skinner worked in Europe conducting comparative studies of European regional plans, "New Towns" concepts, environmental impact, and historic preservation.

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Carnegie Fellowship in International Affairs
Nebraska Regents Scholarship
Nebraska Teachers College Scholarship
Wyoming Historical Research Grant
Wyoming Historical Society Research Scholarship in County History
Wyoming Historical Society 1970 Cumulative Service Award

As a consultant in the fields of history and interpretive planning since 1968, Mr. Murray has been involved with projects which include written historical and archaeological sections of impact studies for Tahoe Basin Planning; Four Alternative Routes for Interstate Highway 15 between Boulder and Butte, Montana; Cholla/Suagaro Transmission Lines of Arizona Public Service Company; Nuclear Power Project; and Denver Regional Transportation District. He has also worked on recreational plans, historical exhibits, reservoir studies, land use analyses, historical sections for coal studies, and interpretive plans for various dams. In addition, he has given numerous talks on subjects related to history and archaeology for various groups and organizations.

Earlier, Mr. Murray was employed by the National Park Service for 10 years, holding such positions as Ranger/Historian of the Custer Battlefield National Monument, Historian of the Pipestone National Monument, and Museum Curator and Supervisory Historian of the Fort Laramie National Historic Site. During this time, he wrote the interpretive planning section for the interagency Master Plan for the South Pass Region of Wyoming, worked on development plans for Fort Philip Kearny and the Sheridan Inn, and was involved in a land disposition study for Fort Robinson.

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Co-author of *Piney Island, A Guide to the Story Area*, Wolf's Den, Story, Wyo., 1970.

The Army on Powder River, Old Army Press, 1969.

Pipes on the Plains, Pipestone Indians Shrine Association, 1968.

Pipestone, A History, Pipestone Indian Shrine Association, 1965.

Fort Laramie's Historic Buildings, An Illustrated Guide, Fort Laramie Historical Association, 1965.

Mr. Murray has also published numerous historical and archaeological articles for various periodicals.

THOMAS L. BARKER

University of Wyoming; B.S., Civil Engineering
University of Wyoming; M.S., Economics

Registered Professional Engineer: Wyoming

Member: Omicron Delta Epsilon, Economics Honorary
American Society of Civil Engineers

Mr. Barker's experience includes working with the State Engineer in Cheyenne, Wyoming, and as a graduate engineer with the Wyoming Highway Department in Buffalo. He also spent two and a half years with the Peace Corps in Ecuador and has had summer jobs with the Forest Service and the Wyoming Highway Department.

KEN PROCTOR

Diablo Valley Junior College; A.A.
Humbolt State College; B.S., Wildlife Management

As a Research Assistant for the Agricultural Experiment Station of Montana State University, Mr. Proctor's responsibilities include reclamation research and wildlife, range, and watershed surveying.

His background includes watershed, range, and wildlife surveying as a Range Technician for the Bureau of Land Management in Winnemucca, Nevada; and working as a park aid at the Fort Humbolt State Historical Monument in Eureka, California.

Mr. Proctor's educational background includes minors in biology and range management.

16.2 Sources Consulted

16.2 Sources Consulted

The following persons at Decker Coal Company were consulted in the preparation of this statement:

1. Frank Kinney, Land and Reclamation Officer
2. Jack Ratchye, Manager (Marketing and Resources)
3. Gary Fletcher, Reclamation Engineer
4. Bob Patterson, Land agent
5. Bill Aikmen, District Safety Officer
6. Louis Gaspar, General Superintendent
7. Tom Wollenzien, Geologist
8. Larry Orrell, Assistant geologist

The following governmental personnel were consulted in the preparation of this statement:

1. Wayne Van Voast, Hydrologist, Montana Bureau of Mines and Geology
Harding, Montana
2. Bland Richardson, Research forester, Forest Service, U.S. Department
of Interior, Logan, Utah
3. Brian Sindelar, Research Associate, Montana State University Agricultural
Experiment Station, Bozeman, Montana
4. Ken Proctor, Research Assistant, Montana State University Agricultural
Experiment Station, Bozeman, Montana
5. Ray Brown, Plant Physiologist, Forest Service, U.S. Department of
Agriculture, Logan, Utah
6. Eugene Farmer, Hydrologist, Forest Service, U.S. Department of
Agriculture, Logan, Utah
7. Ernest Kehrberg, Member of Timber staff at U.S. Forest Service
8. Larry R. Pike, Supervisor, S.E. Area, Department of Natural Resources
and Conservation, Division of Forestry, Billings, Montana
9. Jim Bimando, Planning Coordination Staff, Bureau of Land Management,
Billings, Montana

10. Myron Faltmarsh, Assistant Area Realty Officer, B.I.A. Billings, Montana
11. Ken Walcheck, Environmental Officer, Montana Department of Fish and Game, Miles City, Montana
12. Rick Bondy, Project Engineer, Montana State Water Planning Program
13. Richard L. Hodder, Research Associate, Montana State University Agricultural Experimental Station, Bozeman, Montana
14. Mr. Todd, Commonwealth Edison Company of Chicago, Illinois

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16.3 Historical Bibliography

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16.4 References

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17 APPENDICES

APPENDIX

17.1 RECLAMATION CONTRACT BETWEEN MONTANA BUREAU OF MINES AND GEOLOGY
AND DECKER COAL COMPANY



MONTANA BUREAU OF MINES AND GEOLOGY

BUTTE, MONTANA 59701

April 30, 1971

OFFICE OF THE DIRECTOR

Item # 7 May 7/71 MCM.

Mr. George A. Nugent, Manager
Decker Coal Company
P. O. Box 746
Sheridan, Wyoming 82801

Dear Mr. Nugent:

This letter is confirmation of our oral acceptance of
the General Reclamation Plan for Decker Mine, submitted by
your company and orally approved by us February 4, 1971.

Sincerely,

Uuno M. Sahinen
Director and State Geologist

c.c. Mr. Winston Sahinen

✓	G. NUGENT	<i>gcn</i>
	S. LANG	
	D. JOHNSON	
	J. K. E.	
✓	R. L. ELY	<i>RL</i>
	FILE	✓
✓	Gaudy	<i>AB</i>

RECEIVED

MAY 1 1971

DECKER COAL CO.

SURFACE COAL MINE LAND
RECLAMATION CONTRACT

This contract, made and entered into by and between the STATE OF MONTANA, through its BUREAU OF MINES AND GEOLOGY, hereinafter referred to as BUREAU, and THE DECKER COAL COMPANY, a joint venture and a surface coal mine operator in Montana, hereinafter referred to as the OPERATOR, on the following described land: Tracts "A" and "B" comprising parts of: T. 8 S., R. 40 E.; T. 8 S., R. 41 E.; T. 9 S., R. 40 E.; T. 9 S., R. 41 E.

WITNESSETH

WHEREAS, the mutual objective of the parties of this contract is to accomplish in the State of Montana the reclamation of land affected by surface mining of coal, and

WHEREAS, this contract is entered into pursuant to the provisions of Section 50-1002, R.C.M. 1947,

NOW, THEREFORE, the signatory parties hereby enter into the following agreement:

Definitions: Wherever used or referred to in this contract, unless a different meaning clearly appears from the context:

(a) "Reclamation" means conditioning areas affected by surface mining of coal to make them suitable for uses including but not limited to: forestry, agriculture, grazing, wildlife, recreation, residential and industrial sites.

(b) "Overburden" means all of the earth and other materials which lie above natural deposits of coal. Spoil is the overburden disturbed from its natural state in the process of surface mining.

(c) "Soil" means that earth material modified by biological agencies and weathering so that it will support vegetation.

(d) "Surface mining" means the mining of coal by removing the overburden lying above natural deposits thereof, and mining directly from the natural deposits thereby exposed.

(e) "Affected land" means the land from which overburden has been removed by surface mining of coal or upon which overburden or refuse has been deposited, or both.

(f) "Refuse" means all waste material directly connected with the cleaning and preparation of coal mined by surface mining.

(g) "Final cut" means the last pit created in a surface coal mined area.

(h) "High wall" means that side of the pit adjacent to unmined land.

(i) "Bureau" means the Montana Bureau of Mines and Geology, a department of Montana College of Mineral Science and Technology.

(j) "Reclamation plan" means the description of current land use, topographical data, water data, soils data, leased areas, intended mine areas and description of proposed reclamation of this land with appropriate maps.

(k) "Advisory Committee" means a committee consisting of representatives from the following state agencies: (1) Soil Conservation Committee; (2) Fish and Game Department; (3) State Forester; (4) Lands and Investments; (5) Water Resources Board; (6) Planning and Economic Development; (7) Department of Health.

(1) "Progress report" means a report showing the land which the Operator has affected by surface coal mining and related activities

during the year. Such report shall show the number of acres of affected land and all reclamation accomplished.

SECTION I

(a) A general reclamation plan shall be submitted to and approved by the Bureau before actual mining operations begin.

(b) A reclamation plan and map in detail shall be submitted by the Operator to the Bureau and approval obtained not later than six (6) months after the beginning of surface mining operations, or at such later date as may be permitted by the Bureau upon a showing of good cause. The Bureau must approve or disapprove the detailed reclamation plan within sixty (60) days after date of receiving same. The approval of the plan submitted shall be based upon the advice and technical assistance of the Advisory Committee. Other appropriate state and federal agencies as may be needed for technical assistance may be called upon. The plan will include which part of the land will be reclaimed as forest, pasture, crop, horticultural, homesite, recreational, industrial, or other uses including food, shelter and ground cover for wildlife and shall show the same by appropriate designation on the detailed reclamation plan. The detailed plan shall be accepted by the Bureau only when it has been determined that it provides for the land use most appropriate under the circumstances at the time.

(c) Once the detailed plan has been accepted in writing by the Bureau, it shall become a part of this contract and shall be binding upon the Operator. The Operator shall in good faith implement the accepted plan as soon as it is feasible to do so.

SECTION II

It is agreed that a reclamation plan to be accepted by the Bureau must at least meet the following minimum standards:

(a) There must be reasonable and workable provisions for establishing the kind of vegetative cover commensurate with the land use proposed.

(b) Where operations result in a need to prevent acid drainage or sedimentation on or in adjoining lands or streams, there shall be provisions for the construction of earth dams or other reasonable devices to control water drainage, provided the formation of such impoundments or devices will not interfere with other landowners' rights or contribute to water pollution.

(c) It shall be provided that acid forming materials in the exposed face of a coal seam that has been mined shall be covered by earth or water to a depth of not less than two feet, and all refuse shall be disposed of in a manner that will prevent water pollution, unsightliness, or deleterious effects from such refuse, and water from the mining operations shall be diverted in a manner designed to control siltation, erosion, or other damage to streams and natural water courses.

(d) Provision shall be made for the utilization of soil, where practical.

(e) Provision shall be made for the burial or removal of all metal and other waste.

(f) Provisions shall be made as deemed necessary for access roads commensurate with the land use designated in the detailed plan, and constructed and maintained in such a manner as to control and minimize channeling and other erosion.

(g) There shall be grading specifications commensurate with the topography sought and land use designated.

(h) The Operator shall be required to take reasonable precautions that fires do not start in the coal beds on land which is being surface mined or land which is in the process of being reclaimed. If such fires do start, however, it is the duty of the Operator to take all reasonable measures to extinguish such fires as soon as possible.

(i) The Operator shall submit annually to the Bureau, a progress report.

(j) Archaeological and historical sites in the areas to be mined shall be given appropriate protection.

(k) The detailed plan will provide a specified and reasonable length of time for its completion and shall be as concurrent with mining operations as feasible.

SECTION III

(a) If an acceptable reclamation plan has not been approved by the Bureau within the time limit provided herein or within such extension thereof as may be permitted by the Bureau upon a showing of good cause, this contract may be terminated and the Operator may be required to comply with any applicable laws or regulations of the State of Montana then in effect.

(b) If adverse weather conditions, soil characteristics, or lack of moisture preclude the completion of reclamation in accordance with the detailed plan, the Bureau may, at the request of the Operator, extend the reclamation period from year to year, not to exceed five years, while the Operator attempts approved alternative reclamation procedures in accordance with Section IV below. If, after

five years of bona fide effort to reclaim the land, the land does not respond to treatment, it shall be deemed unreclaimable and the Operator shall be relieved of further responsibility under the law.

(c) If reclamation in substantial accordance with the detailed plan has not been completed within the time specified for reasons other than those beyond the reasonable control of the Operator, and the Operator does not qualify under Section III (b) of this contract, the Operator may be deemed to be in breach of its obligations under this contract. The Bureau may thereupon order a suspension of the Operator's operations; and the Bureau may institute proceedings for breach of contract or for payment of the performance bond or for both if circumstances dictate.

SECTION IV

(a) At any time during the period of reclamation, the Operator may for good reason submit to the Bureau a new reclamation plan, or amendments to the existing plan, including extensions of time.

(b) The Bureau shall approve the proposed new reclamation plan or amendments to the existing plan if the Bureau finds that the Operator has in good faith carried on reclamation according to the existing plan, and the proposed new plan, or amendments to the existing plan, will result in reclamation as desirable or more so than the reclamation proposed under the existing plan, or that it is highly improbable that reclamation will be successful unless the existing plan is replaced or amended. When accepted, the proposed new reclamation plan or the proposed amendments to the existing plan shall become a part of this contract and shall be binding upon the parties.

(c) This section shall not impair the operation of Section III
(b) of this contract.

SECTION V

The Operator shall provide a performance bond or its accepted alternatives in an amount commensurate with the estimated cost of reclamation, but in no case shall the bond be less than two hundred (\$200) dollars per acre. The cost of bond may be considered a cost of reclamation. The copy of bond or its accepted alternatives shall be filed with the Bureau.

SECTION VI

The Bureau or its accredited representatives may enter upon the lands of the Operator at all reasonable times for the purpose of inspection to determine whether the provisions of this contract have been satisfied.

SECTION VII

This contract, reclamation plan and amendments accepted by the Bureau shall be made a public record open to inspection.

SECTION VIII

This contract shall become effective when signed by the Bureau and the Operator, and shall remain in force until terminated by mutual consent, provided all obligations assumed hereunder have been completed. Amendments to this Agreement may be proposed by either party and shall become effective upon approval by both parties.

IN WITNESS WHEREOF, the parties hereto have subscribed their names and affixed their seals as of the 4th. day of February, 1971.

FOR THE STATE OF MONTANA,
MONTANA BUREAU OF MINES AND GEOLOGY
(The Bureau)

Uuno M. Sahinen

Uuno M. Sahinen, Director
Montana Bureau of Mines and Geology

Edwin G. Koch

Edwin G. Koch, President
Montana College of Mineral Science and Technology

FOR DECKER COAL COMPANY

Attest:

ATP

George A. Nugent

George A. Nugent, MANAGER

Detailed Reclamation Plan for Decker Coal Mine

In accordance with Paragraph (b), Section I of the Surface Coal Mine Land Reclamation contract between the Decker Coal Company and the State of Montana dated February 4, 1971, the following plan is submitted, along with the attached exhibits, for consideration as a detailed reclamation plan. It is to be understood that this plan has been formulated in the absence of any quantitative plant growth data on the actual spoils to be deposited and that it can be amended at such time as that data is available.

The Decker mine will be situated in the S 1/2, NE 1/4, Sec. 9, S 1/2 Sec. 10, Sec. 15, Sec. 16, NE 1/4 NW 1/4, SE 1/4 Sec. 17, N 1/2 Sec. 21, S 1/2 Sec. 8, and the N 1/2 Sec. 22, all in T. 9 S., R. 40 E. MPM. Overburden stripping associated with mine operation is scheduled to begin upon the completion of erection of a large electric walking dragline during August of 1972.

The mining plan under consideration covers a larger area than that described in the general reclamation plan submitted at the time of reclamation contract execution. The direction of mining in pits 2 and 3 have been changed with the elimination of the outside box cut along the burn line in pit 3. Also a third stripping area is envisioned in the southeasterly portion of the coal mine. This area shows as Pit I on the attached exhibit. Material is to be removed from the northern portion of this pit by motor scrapers from the area designated "Overburden - 2,000,000 CY to R.R. & County Fill" for structural purposes prior to the beginning of actual surface mining activity. This material, while not spoil in the accepted sense, will be provided with a vegetative cover suitable to the use for which the embankments were constructed.

Reservoirs 1, 2, 3 and 4, shown on the attached exhibits are optional depending on their usefulness in reclamation.

The initial stripping rate will be between 7,750,000 and 11,000,000 cubic yards per year, depending upon coal sales. This means that between 75 and 100 acres per year will be affected by strip mining, not including haul roads and other more permanent types of disturbance.

It is currently proposed that the spoil area be reclaimed as pasture land with subordinate use as wildlife shelter and forage areas. Such grading as will allow the establishment of this vegetative growth will be undertaken at the time of inception of stripping operation.

An agreement has been executed between the Montana Agricultural Experiment Station and the Decker Coal Company to provide for laboratory and greenhouse testing of soil and plant types so that the workable reclamation scheme can be provided. The intent of this program is stated as follows:

1. Establish desirable vegetation on the mined area.
2. Provide habitat, food, water and protection to various forms of wildlife.

3. Maintain and enhance water, soil and air quality.
4. Preserve, restore and enhance natural beauty.
5. Enhance future recreational opportunities.

As mentioned above, the results of this program will be utilized to determine the exact plant mixture and fertilizer requirements.

In the absence of data from the current study, we would submit one or the other of the following seeding plans:

Plan A - Spring Seeding (March - early April)

Seed Mixture:

Cereal Rye	50 lbs./acre
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Fall Seeding (September - early November)

Seed Mixture:

Nordam crested wheatgrass	5 lbs./acre
Standard crested wheatgrass	5 lbs./acre

Fertilizer:

Ammonium nitrate (33-0-0)	250 lbs./acre
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Plan B - Fall Seeding

Seed Mixture:

Fall rye	30 lbs./acre
----------	--------------

Intermediate wheat	
Manchar Brome	
Western wheat	Mixed and seeded
Russian wild rye	15 lbs./acre

Fertilizer:

10-34-0	200 lbs./acre
---------	---------------

Natural drainage will be diverted around the mining area by the diversion dams and drainage ditches, as shown on the attached exhibit. Water resulting from precipitation in the mining area and groundwater produced from the coal seam and/or the surrounding sediments, will be pumped from the active mining area to suitable settling ponds in, or immediately adjacent to, the active mining area for gravity settling prior to utilization for irrigation or discharge into the surface drainage ditches. It is not anticipated that the water produced from the coal mining operation will be of a highly acid nature, owing to the extremely low sulfur content of the coal to be mined. Therefore, it is presently felt that neutralization will not be required.

According to Paragraph (d) of Section II of the reclamation contract, topsoil stockpiling and reuse is desirable. Even though it is intended to use a large dragline as a primary stripper, which would make stockpiling and reuse of topsoil difficult, additional equipment will be provided to accomplish this end. It is proposed that one or two self-loading scrapers and a large crawler bulldozer will be dedicated to the recontouring and re-topsoiling of the dragline spoil banks. This, of necessity, will ameliorate the steepness of the dragline spoil bank slopes so that the wheel equipment can traverse them. No set limits for slopes are postulated at this time other than that they be traversable by wheeled earth moving equipment.

Paragraph (e) of Section II of the above-referenced reclamation contract stipulates that provision be made for burial of metal and/or other wastes resulting from the mining operation. This objective can readily be achieved by depositing whatever wastes are generated in the course of the mining operation in the V-shaped valleys between the spoil pile peaks prior to re-contouring. The earth moved during the regrading operation will suffice to bury the wastes where they will not be an aesthetic or chemical liability in the reclamation program.

In accordance with Paragraph (j), an archeological survey of the mine area has been contracted for with the Montana State Archologist's office and is well underway. Should this survey result in the definition of locales of unusual archeological interest, efforts will be made to protect the archeological values so that they can be suitably utilized. It is anticipated that this utilization can be made conformable with the mining plan by removal of any material of archeological significance rather than the establishment of archeological "islands" in the mining area which would be most disruptive to an orderly and efficient coal extraction sequence.

In accordance with Paragraph (k) of Section II of the reclamation contract, it is specified that reclamation will initially be attempted within two growing seasons of the time of initial disposition of the spoil. It is

possible that reclamation would be attempted during the first growing season but operating exigencies may dictate that reclamation be deferred until the second growing season. A conscientious effort will be made to revegetate the disturbed areas as promptly as possible, consonant with the conduct of the mining operations.

It is intended that the bond filed at the time of the execution of the reclamation contract, February 4, 1971, will remain in force to cover the bonding requirements in Section V of the subject contract.

It is hoped that this initial detailed reclamation plan will satisfy the preliminary requirements for approval by the Montana Bureau of Mines and Geology, in accordance with the contract provisions. It is re-emphasized that test work currently in progress will be utilized to modify this plan as soon as data becomes available. At that time a revised plan will be prepared and submitted for approval.



Argonaut Insurance Company

HOME OFFICE: 250 MIDDLEFIELD ROAD • MENLO PARK, CALIFORNIA 94025

BOND FOR PERFORMANCE OF SURFACE COAL MINE RECLAMATION AGREEMENT

KNOW ALL MEN BY THESE PRESENTS, that we DECKER COAL COMPANY

as Principal, and ARGONAUT INSURANCE COMPANY, 550 California Street, San Francisco, California, as Surety, are held and firmly bound unto the STATE OF MONTANA THROUGH ITS BUREAU OF MINES AND GEOLOGY, MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY, BUTTE, MONTANA, as Obligees in the sum of TWENTY THOUSAND AND NO/100 (\$20,000.00) DOLLARS, lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above named Obligee has required the Principal, under the terms of an agreement, to furnish a Performance Bond for the RESTORATION OF LAND AFFECTED BY SURFACE MINING OF COAL as is more specifically set forth in said Agreement, to which reference is hereby made;

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if the Principal shall well and truly perform and carry out the covenants, terms, and conditions of said Agreement, then this obligation to be void; otherwise to remain in full force and effect.

Sealed, with our seals and dated this 23rd day of March, 1971.

ATTEST:

By

James L. Koley

DECKER COAL COMPANY

By Donald L. Sturm

Donald L. Sturm
Member of the Management Committee
and Attorney-in-Fact

ARGONAUT INSURANCE COMPANY

By Louis A. Luzzi

Louis A. Luzzi, Attorney-in-Fact

COUNTERSIGNED:

COGSWELL AGENCY

By

E. B. Cogswell

Resident Agent of the State
of Montana

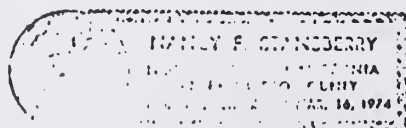
State of California

County of

ss:

On this 23rd day of March, 19 71, before me

personally appeared Louis A. Luzzi
known to me to be an Attorney-in-Fact of Argonaut Insurance Company, the corporation described in the within instrument, and he acknowledged to me that he executed the within instrument as the act of the said Argonaut Insurance Company in accordance with authority duly conferred upon him by said Company.



NOTARY PUBLIC

My Commission Expires _____

Argonaut Insurance Company

HOME OFFICE • MENLO PARK, CALIFORNIA

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That ARGONAUT INSURANCE COMPANY, a corporation organized and existing under the laws of the State of California, and having its principal office in Menlo Park, California, does hereby constitute and appoint

LOUIS A. LUZZI

of San Francisco, California

its true and lawful Attorney(s)-in-fact to sign, execute, seal, acknowledge and deliver for, and on its behalf, and as its act and deed, at any place within the United States, or, if the following line be filled, only within the area therein designated

any and all bonds, recognizances, undertakings, contracts of indemnity or other writings obligatory in the nature thereof, as follows:

ANY SUCH OBLIGATIONS WITHIN THE UNITED STATES, IN ANY AMOUNT, AND ANY MODIFICATIONS AND EXTENSIONS THEREOF.

And said Company hereby ratifies and confirms all and whatsoever said Attorney(s)-in-fact may lawfully do in the premises by virtue of these presents.

This appointment is made under and by authority of the following Resolution passed by the Board of Directors of said Company at a meeting held at the principal office of said Company, a quorum being present and voting, on the seventh day of July, 1959, which resolution is still in effect:

"RESOLVED, that the President or any Vice President, in conjunction with the Secretary or any Assistant Secretary, be and they are hereby authorized and empowered to appoint Attorneys-in-fact of the Company, in its name and as its acts, to execute and acknowledge for and on its behalf any and all bonds, recognizances, undertakings, contracts of indemnity or other writings obligatory in the nature thereof, with power to attach thereto the seal of the Company. Any such writings so executed by such Attorneys-in-fact shall be as binding upon the Company as if they had been duly executed and acknowledged by the regularly elected Officers of the Company in their own proper persons."

IN WITNESS WHEREOF, ARGONAUT INSURANCE COMPANY has caused these presents to be sealed with its corporate seal, duly attested by its Vice President and its Assistant Secretary, this 17TH day of DECEMBER 1970

ARGONAUT INSURANCE COMPANY

M. J. Smith
Vice President

L. M. Snider
Assistant Secretary

(SEAL)

THE STATE OF CALIFORNIA
COUNTY OF San Francisco

ss.

On this 17TH day of DECEMBER 1970, before me came the above named Vice President and Assistant Secretary of Argonaut Insurance Company, to me personally known to be the individuals and officers described herein, and acknowledged that the seal affixed to the preceding instrument is the corporate seal of Argonaut Insurance Company and that the said corporate seal and their signatures as officers were duly affixed and subscribed to said instrument by the authority and direction of said Corporation.

(SEAL)



[Signature]
Notary Public
My Commission Expires

I, the undersigned Secretary of Argonaut Insurance Company, hereby certify that the above and foregoing is a full, true and correct copy of the Original Power of Attorney issued by said Company, and do hereby further certify that the said Power of Attorney is still in force and effect.

And I do hereby further certify that the Certification of this Power of Attorney is signed and sealed by facsimile under and by the authority of the following resolution adopted by the Board of Directors of the Argonaut Insurance Company at a meeting duly called and held on the 25th day of May 1965, and that said resolution has not been amended or reopened:

"RESOLVED, that the signature of the Secretary or any Assistant Secretary of this Corporation, and the seal of this Corporation, may be affixed or printed by facsimile to any certificate to a Power of Attorney of this Corporation, and that such printed facsimile signature and seal shall be valid and binding upon this Corporation."

GIVEN under my hand and the seal of said Company, at Menlo Park, California, this 23rd

day of March

19 71

R. W. McElroy
Secretary

17.2 APPLICATION FOR CONTRACT AND PLAN OF OPERATION AND METHOD AND
MANNER OF RECLAMATION



STATE OF MONTANA
DEPARTMENT OF STATE LANDS

Capitol Building
Helena, Montana 59601
Phone 406/449-2074

APPLICATION FOR
CONTRACT

Pursuant to Chapter 224, Session
Laws of 1971; Open Cut or Strip
Mining of Coal, Bentonite, Clay, Sand,
Gravel, Phosphate, and Uranium.
(See Instructions Below)

NAME AND ADDRESS OF APPLICANT (PRINT OR TYPE)		SIZE AND LEGAL DESCRIPTION of area affected	
Decker Coal Company P. O. Box 746 Sheridan, Wyoming 82801		S $\frac{1}{2}$, NE $\frac{1}{4}$ Sec. 9; S $\frac{1}{2}$ Sec. 10; Sec. 15, Sec. 16; NE $\frac{1}{4}$ NW $\frac{1}{4}$, SE $\frac{1}{4}$ Sec. 17; N $\frac{1}{2}$ Sec. 21; S $\frac{1}{2}$ Sec. 8, and the N $\frac{1}{2}$ Sec. 22; all in T. 9 S., R. 40 E., M.P.M.	
TELEPHONE NO.		SEC. ☐ T ☐ N ☐ S see above	RANGE ☐ E ☐ W M.P.M.
OWNERSHIP: SURFACE OF LAND TO BE SURFACED MINED (SHOW NAMES AND ADDRESSES)		COUNTY Big Horn	
1. Montana State Land & Investments Helena, Montana		DISTANCE 20 miles	DIRECTION FROM Northeast
2. Norsworthy & Reger, Inc. Securities Building Billings, Montana		NEAREST COMMUNITY Sheridan, Wyoming	
OWNERSHIP: MINERAL RIGHTS (SHOW NAMES AND ADDRESSES)		TYPE OF OVERBURDEN Mixture: clay soil sandstone shale	
U. S. Dept. of Interior, B.L.M. Billings, Montana		APPROX. MAX. DEPTH OF OVERBURDEN 150 feet	
State of Montana Helena, Montana		AVE. DEPTH OF OVERBURDEN 100 feet $\pm$	
CONTRACTORS WHO WILL BE WORKING ON THE PROJECT. (SHOW NAMES, ADDRESSES AND FUNCTION)		MINERALS TO BE MINED OR REMOVED coal	
Decker Coal Company - Box 746, Sheridan, Wyoming		QUANTITY (YARDS) OVERBURDEN 240 mil. MINERAL 120 mil.	
Big Horn Construction Co. Box 1009, Sheridan, Wyoming		ESTIMATED TOTAL ACRES TO BE SURFACE MINED 2000 acres more or less	
INSTRUCTIONS THIS APPLICATION MUST BE ACCOMPANIED BY:		ESTIMATED NUMBER OF ACRES TO BE MINED IN FIRST YEAR 45 acres	
1. FEE OF \$50.		METHOD OF MINING strip mining	
2. BOND OR OTHER SURETY.		EST. MAX. DEPTH TO BE SURFACE MINED 50 feet	
3. "PLAN OF OPERATION AND METHOD AND MANNER OF RECLAMATION." (FORM REC-2)		DATE OPERATION WAS (WILL BE) COMMENCED July 1972	
4. MAP OF INTENDED OPERATION.		VOLUME OF MATERIAL REMOVED TO DATE 74,856 ton test sample	
FOR DEPARTMENT USE ONLY		PRESENT LAND USE(S) OF AREA TO BE MINED pasture land	
DATE ACCEPTED BY DEPARTMENT:		PURPOSE FOR WHICH THIS LAND IS TO BE USED AFTER MINING pasture land	
ACCEPTED BY:		APPLICANT AFFIRMS THAT HE (IT) HAS THE RIGHT AND POWER BY LEGAL ESTATE OWNED TO MINE BY OPEN OR STRIP MINING THE LANDS HERETOFORE DESCRIBED.	
FEE RECEIVED:		THIS APPLICATION, AND THE CONTENTS HEREIN, TO BE ATTACHED TO THE CONTRACT AND BY SUCH ATTACHMENT TO BECOME A PART OF THE TERMS THEREOF. (RETURN BOTH COPIES)	
CONTRACT NUMBER ISSUED		SIGNATURE <i>George A. Nugent</i>	
		DATE 2/22/72	
		TITLE George A. Nugent General Manager	
		FEE: \$50.00	

State of Montana
DEPARTMENT OF STATE LANDS

Capitol Building
Helena, Montana 59601
Phone 406/449-2074

PLAN OF OPERATION
AND
METHOD AND MANNER
OF
RECLAMATION

Return both copies with application

NAME AND ADDRESS OF OPERATOR (Type or Print) Decker Coal Company P. O. Box 746 Sheridan, Wyoming 82801	LEGAL DESCRIPTION OF AREA AFFECTED S $\frac{1}{2}$, NE $\frac{1}{4}$ Sec. 9; S $\frac{1}{2}$ Sec. 10; Sec. 15; Sec. 16; NE $\frac{1}{4}$ NW $\frac{1}{4}$, SE $\frac{1}{4}$ Sec. 17; N $\frac{1}{2}$ Sec. 21; S $\frac{1}{2}$ Sec. 8, and the N $\frac{1}{2}$ Sec. 22; all in T. 9 S., R. 40 E., M.P.M. <table border="1"><tr><td>SEC.</td><td>T</td><td>☐ N</td><td>RANGE</td><td>☐ E</td><td>COUNTY</td></tr><tr><td>see above</td><td></td><td>☐ S</td><td></td><td>☐ W MPM</td><td>Big Horn</td></tr></table>	SEC.	T	☐ N	RANGE	☐ E	COUNTY	see above		☐ S		☐ W MPM	Big Horn
SEC.	T	☐ N	RANGE	☐ E	COUNTY								
see above		☐ S		☐ W MPM	Big Horn								

DESCRIBE BRIEFLY THE PLAN OF OPERATION: Include such information as equipment used and method of mining.

Initial stripping will consist of scraper excavation in the SW $\frac{1}{4}$ of Section 15, T. 9 S., R. 40 E., The material removed will be utilized as embankment fill for a railroad and highway grade to be constructed in the general area thru Sections 10, 15 and 22. Upon completion of the erection of a 41 cubic yard dragline, it will be used to remove the overburden to top of coal. The coal will be loaded with

~~16 cu. yd. shovel and transported to tipple with Caterpillar 660 haulers.~~
METHOD AND MANNER OF RECLAMATION: Must include, but not limited to: present and intended land use; significant soil, water, and topographic information; present and proposed vegetation and method used to reestablish vegetation; proposed water diversions and dams.

See attached detailed Method and Manner of Reclamation Plan

ESTIMATE OF RECLAMATION COST PER ACRE: \$400.00/acre

MAP: Submit a map of the disturbed and adjacent land with the following information: Present mine area; area to be mined this year; total area to be strip mined; location of streams and natural drainageways; location of existing and proposed access, support, and haul roads and railroads; location of legal subdivision boundaries.

SIGNATURE 	TITLE General Manager	ADDRESS Box 746-Sheridan, Wyo.	DATE 2/22/72	
For Dept. File Only	Plan Accepted By:	Date	Contract No.	Plan Not Accepted Because:

17.3 1971 ARCHAEOLOGICAL SURVEY, DECKER COAL COMPANY LANDS, BIG HORN COUNTY,
MONTANA

1971 ARCHAEOLOGICAL SURVEY,
DECKER COAL COMPANY LANDS,
BIG HORN COUNTY, MONTANA

By

Dale E. Fredlund

Field Director

University of Montana Statewide Archaeological Survey

July 1972

Submitted to

Decker Coal Company

In Fulfillment of an Agreement Between

Decker Coal Company and the University of Montana Foundation

Dated May 19, 1971

1971 ARCHAEOLOGICAL SURVEY,
DECKER COAL COMPANY LANDS,
BIG HORN COUNTY, MONTANA

Introduction

In May 1971, the Decker Coal Company, as part of its environmental quality program, contracted through the University of Montana Statewide Archaeological Survey for an archaeological survey of lands in Big Horn County, Montana, leased by the company for purposes of coal strip mining. It was the goal of the company to have salvaged all archaeological remains before their possible destruction by the mining process.

The survey was begun on July 25, 1971, and completed on August 1, 1971, with field work being accomplished by members of a Statewide Archaeological Survey crew under the supervision of Dale E. Fredlund.

The lease lands are located in south-central Montana, just north of the Montana-Wyoming border, 1/2 mile west of the Tongue River, and 1 mile north of the town of Decker, Montana. They include the following section and subsections of Township 9 South, Range 40 East: Sec. 8, the southeast one-quarter of the south one-half; Sec. 9, the northeast one-quarter of the south one-half of the south one-half; Sec. 10, the southwest one-quarter of the south one-half; Sec. 15, the west one-half; Sec. 16, all; Sec. 17, the northeast one-quarter; Sec. 21, the northwest one-quarter of the east one-half of the northeast one-quarter.

Located in a rather arid, short grass plains region, the

survey area lies within an almost flat erosional basin encircled by clinker-capped sandstone ridges and dissected by a dendritic system of dry wash gulches (Fig. 1).

Description of Environment

Topography. The topography of the survey area, located just 35 miles east of the Big Horn Mountains, is characterized by undulating hills, averaging 3500 feet above sea level, and cut by numerous eroded dry washes. Occasional seeps and springs dot the landscape, but the nearest natural, permanent source of potable water is the Tongue River, 1/2 mile to the east. Originating in the Big Horn Mountains and flowing northeastward through Big Horn, Rosebud, and Custer counties before emptying into the Yellowstone River near Miles City, Montana, the Tongue has cut through Quaternary deposits along its course, forming a series of gravel terraces and a rather broad flood plain 1/2 mile or more in width (Baker 1929:29).

Geology. The predominant geologic strata of the area, which compose most of the rock outcrops, belong to the Tongue River member of the Fort Union formation and to the overlying Wasatch formation. These horizontally bedded, sedimentary formations are of Tertiary age, and consist of alternating strata of sandstone, shales and coal (Baker 1929:24). Many of the coal strata have burned from natural causes, metamorphosing in turn the adjacent siliceous sediments into gray and red porcelanites. The resulting fused lithic mass remains as a highly erosion-resistant clinker layer capping most of the hills and buttes in the area. Geological uplift has

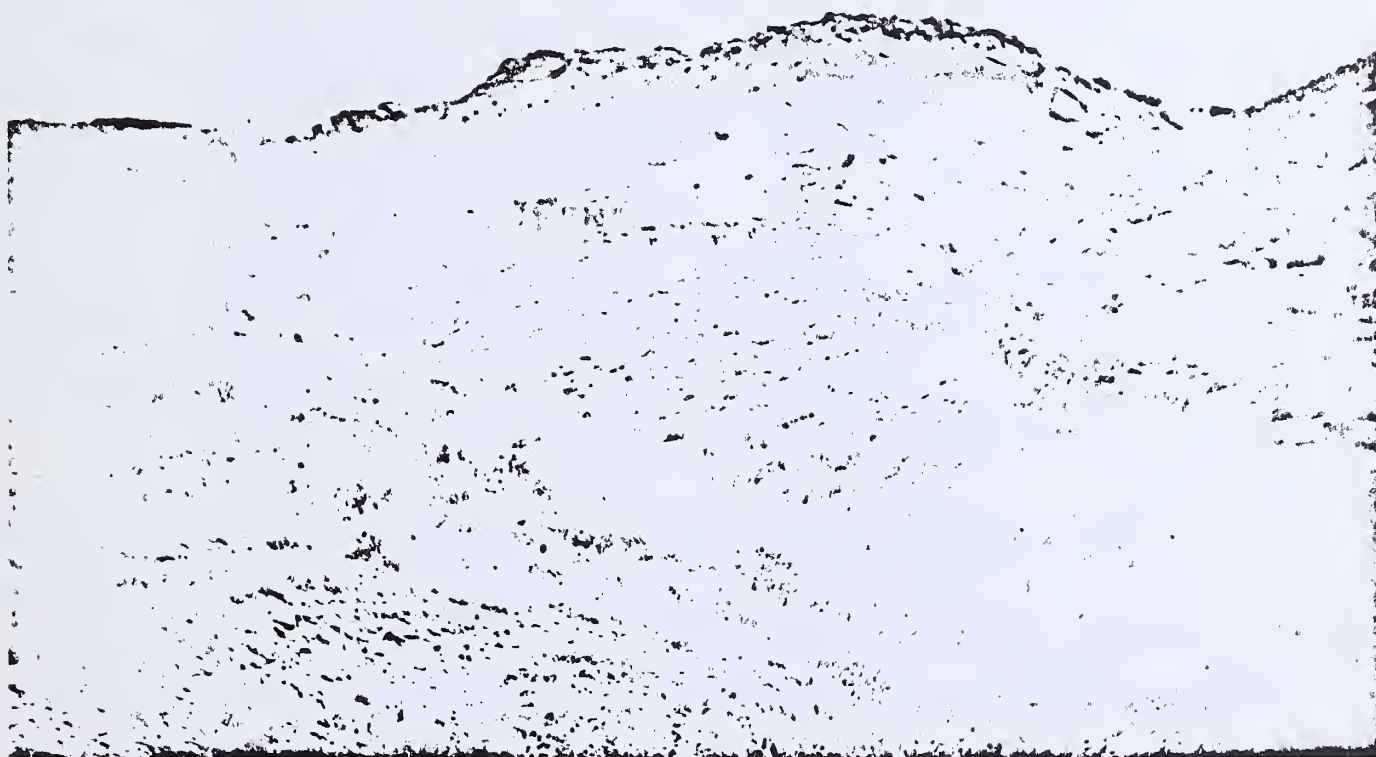


Fig. 1. A typical dry wash gulch, Decker, Montana area.

tilted the Tongue River strata to the southeast about 4° (Taft 1907:132); thus the entire area is now undergoing dissection by the forces of erosion, as evidenced by the many gulches present.

Climate. Using the Holdridge system (Holdridge 1967) for determining climate types, south-central Montana can be classified as subhumid, short grass plains or steppe. The hottest month of the year is July, when temperatures average around 70°; December is usually the coldest month with temperatures averaging near 20°. Mean annual precipitation is approximately 15 inches, one-third of which is snow, with May and June being the wettest months. There is an average of 125 frost-free days, the growing season for native plants beginning from March to June (Hodder et al. 1971:2) and the first frost usually arriving around mid-September.

In the winter season, temperatures may drop to as low as -40°, but these cold waves are generally short lived, since warm chinook winds frequently bring sudden pronounced temperature changes. Snow, which falls in quantities from a few inches to several feet at a time, is usually swept by winds from the ridges and flats and piled in large drifts on the leeward side of hills and in dry washes. Primarily an arid region, snow or rain usually comes in short violent storms. Flash floods which have eroded the land into a web of gulches are frequent.

Flora and Fauna. The principal grasses of the short grass plains include Bouteloua gracilis (Blue grama), Bouteloua hirsuta, Buchloe dactyloides, and Hilaria jamesii (Shelford 1963:344). In

terspersed throughout the grassy flats, sagebrush and prickly pear cactus flourish. Cottonwood thrives in the more moist areas along stream courses. On the sandstone ridges, juniper and ponderosa pine grow in sparse stands.

Food plants available on the northern plains in general include (Mulloy 1958:20-21):

Box elder	Sunflower
Currant	Wheat grass
Wild plum	Prickly pear
Sand cherry	Raspberry
Chokecherry	Serviceberry
Buffaloberry	Hawthorn
Prairie plum	Milkweed
Wild red cherry.	Buffalo pea
Prairie potato	Gooseberry
Wild grape	Dock
Ground cherry	Indian rice grass
Giant wild rye	Sego lily
Onion	Goosefoot
Wolfberry	Valerian
Burr oak	Elderberry
Bitterroot	Oregon grape
Bearberry	Snowberry

The short grass plains environment traditionally has supported an abundance and variety of animal life, a factor which made the region attractive to human populations. Of primary importance in prehistoric and early historic times were the large ungulates, especially the bison, estimated by Butzer (1964:140) to have numbered 60 million. Bison were the main source of food for amer-indians inhabiting the plains, and because of primary dependence on them for subsistence and their migratory nature, the movements of the bison affected the pattern of human migration. To arrive at an understanding of human population movements in response to bison migration is difficult, however, because the migratory patterns of the bison are obscured by contradictory studies. Shelford (1963:

544), for example, states that bison migrated over a range of 200 to 300 miles, moving northward each spring, then southward in early winter. Garretson (1938:52), on the other hand, holds that the primary movement of bison in the northern portion of their natural range was from east to west--from the foothills of the mountains in the winter to the plains in the spring and summer, and back to the foothills by late fall. The grazing characteristics of the ungulates, together with their migratory natures, served to enrich and perpetuate the short grass prairie conditions.

Other game animals of importance were the pronghorn antelope, elk, deer, grizzly bear, and black bear, all of which occurred in great numbers in the area. Bighorn sheep also would have been found near the foothills.

Rodents constituted an additional food resource for many predator species (including man) on the northern plains. The more common rodents included beaver, muskrat, porcupine, white-tailed jackrabbit, mouse, mole, ground squirrel, packrat, and gopher. Common predators included the coyote, mountain lion, mink, otter, fox, bobcat, skunk, brush wolf, ferret, weasel, badger, golden and bald eagle, and several species of hawks and owls. Perhaps the most famous predator of the plains was the "lobo" or buffalo wolf, who harassed the bison herds, preying upon the old, crippled, sick, and calves. The rattlesnake, bull snake, and the plains garter snake inhabited the region, being both predator and prey.

According to Shelford (1963:346), the more common small birds

Inhabiting the region included:

Horned lark	Lark bunting
McCowan longspur	Sprague's pipet
Chestnut-collared longspur	Brewer's sparrow
Lark sparrow	Grasshopper sparrow
Western meadowlark	Lesser prairie chicken

Migratory waterfowl, sagehen, and grouse were also common.

With an environment so rich in game, it is not surprising that man has occupied the area for thousands of years.

Prehistory and History of South-Central Montana: Background Statement

Our country is the most beautiful of all. Its rivers and plains, its mountains and timber lands, where there was always plenty of meat and berries, attracted other tribes, and they wished to possess it for their own (Linderman 1962:47-48).

Thus Plenty Coups, chief of the Crow Indian tribe, described the lands of south-central Montana, which were occupied by his people at the time of white contact. The Crow, the Cheyenne, the Blackfeet, and the Sioux are known to have been the last Indian inhabitants of this area, and their lifeways have been fairly well documented by ethnohistorical and ethnographical studies (Curtis 1911; Ewers 1958). Knowledge of the specific occupants and their lifeways before the protohistoric period is much more nebulous, however. It is known from archaeological data that man first moved into the northern plains area approximately 13,000 years ago. These first inhabitants were big game hunters whose cultural complexes have come to be called Clovis and Folsom.

Early Prehistoric Period. The fluorescence of the Clovis and Folsom traditions apparently occurred around 11,000 B.C. and 8000

B.C., respectively. For Clovis hunters, mammoths were the major source of food, while Folsom peoples hunted now-extinct forms of bison. Characteristic of both traditions' artifact assemblages are distinctive fluted points. The occasional miscellaneous surface finds of these fluted points throughout Montana and the northern plains indicates that the area was utilized to some degree by these early hunters. Also, but less frequently, the fluted points are recovered in subsurface sites, such as the Wilsall site (24PH506) near Wilsall, Montana (Taylor 1969) which contained artifacts belonging to the Clovis tradition, and the MacHaffie site near Helena, Montana (Forbis and Sperry 1952) which contained Folsom artifacts.

By 7000 B.C., these early hunters began to manufacture a variety of new projectile point types. The new point styles were generally long lanceolate points, lumped by archaeologists under the rubric "Plano" and classified into two variations, Plainview and Parallel Flaked (Willey 1966:44). Like the Folsom hunters, Plano peoples were hunters of bison, but Bison bison primarily. The area they inhabited was apparently more extensive, however. Plano peoples spread throughout the northern plains, and possibly became the first people to intensively occupy Alberta (Wormington and Forbis 1965:185).

An Eden Valley point, one of the Parallel Flaked Plano point types, found during the survey (Fig. 2) evidences the utilization of what is now Decker Coal Company lands by Plano peoples.

Middle Prehistoric Period. The Plano tradition (and with it the Early Prehistoric Period) rapidly began to wane around 5000 B.C.

a time that coincided with the initial phases of a major change in climate to one slightly warmer and drier than had existed previously--the altithermal. The altithermal is believed to have altered the environment to the extent that the lifeways of the inhabitants of the plains necessarily had to change. "Buffalo hunters of the northern plains at the beginning of the altithermal were probably obliged to move to more favored regions to the north and east, or their numbers were reduced in accordance with the natural resources available" (Wormington and Forbis 1965:191).

Whether the hunters moved out of the area or reduced the sizes of their bands, it is known that the food resources of peoples during this period, the Middle Prehistoric Period, seems to have become more diversified. Vegetable foods were apparently utilized more frequently (Wedel 1964:201), and although limited big game hunting continued, lesser animals, such as rodents, became a more important part of the diet. Because of the increased variety of food sources exploited, the term "foragers" has often been applied to the peoples of the northern plains during this period. With the change in the food resources, there was an accompanying change in the technology. Grinding stones first appear in artifact assemblages of sites belonging to this period, and projectile points were smaller than the large blades of Early Prehistoric Period hunters. The new projectile point types of this period (3000 B.C. to A.D. 500) are commonly grouped as the McKean complex (Caldwell and Conner 1968).

Late Prehistoric Period. Approximately A.D. 500 marks the beginning of another transition in the lifeways of the inhabitants of the northern plains, and also the beginning of the Late Prehistoric Period. The change that took place at this time was one more of degree than kind, however, and was very gradual. There was a greater dependence of the bow and arrow and less on spears and spear-throwers; use of pottery increased; populations expanded; and, there is some indication that new people practicing agriculture moved into the area of eastern Montana at this time, as evidenced at the Hogan site (Mulloy 1958:215).

Perhaps the most significant change of this period was the introduction of the horse in the 16th century--an addition to the economic potential which affected a change to some degree in nearly every aspect of the Plains culture. So important was the horse that Wissler (1927:154) has termed the period from A.D. 1540 to 1880, during which time the horse diffused to all the Plains tribes, as the "horse culture period". The change brought about by the introduction of the horse was a dramatic one, but one superposed on, and limited by, previous economic patterns. Emphasizing that the change was in degree rather than in kind, Beardsley (1956:147) defines the equestrian hunting community pattern of the Plains Indian as "Hunters and gatherers who possess the horse as a domestic animal, but use it primarily as a tool for hunting rather than a food source." Prior to the introduction of the horse, travel was by foot with

dogs being used as beasts of burden. Hence, travel was restricted by limits of human endurance and proximity to water and fuel. Kroeber (1939:87) credits the horse with making the vast plains a desirable place to live, in spite of the area's lack of general water and fuel resources. Because of the horse, the range of movement of native peoples within the plains was greatly increased; additionally, peoples moved into the plains from all directions and occupied areas that previously were rarely, if at all, utilized.

It was these equestrian hunters who inhabited the northern plains during the historic period, most of the groups being relative newcomers to the area. The plains immigrants almost surely displaced indigenous groups, one of which was probably the Shoshone who apparently controlled a major portion of southern Montana until they were forced southward into Wyoming by the Blackfeet (Wedel 1964:212).

Historic Period. Just prior to, and at the time of white contact, aboriginal ownership of lands that were to become south-central Montana and northern Wyoming was in a state of flux, as it was in the rest of the northern plains. The Crow tribe, having separated from the Hidatsa around 1750 (Dearss (1970:2), had moved into the area from the east, claiming a major part of what is now south-central Montana. Focusing their utilization of the area along the Big Horn River, they were primary occupants of the region in early historic times, but by the middle of the 19th century were fighting to retain their ownership.

Crow territorial claims were constantly challenged in the mid-19th century by the Teton Dakota Sioux, who moved west as far as the Powder River. On the south, the Northern Cheyenne pushed their territory ever northward into Crow country. From the north, the powerful Blackfeet tribe harassed the Crow, threatening to expand into the northern part of Crow lands (Ewers 1958: 77). Surrounded by such powerful enemies, the Crow wisely aligned themselves with the whites and aided the frontier armies of the United States during the Indian wars of the latter part of the 1880's. After the "winning of the west" by the government forces, the Crow, largely because of their role as an ally during the Indian wars, were able to retain much of their land.

At the same time that the tribes were struggling for control of south-central Montana, white interest in the region began to stir. When actual white contact was first made is not known, however among the first white men to venture into the region was Pierre la Verendrye in 1743 (Laut 1904). Shortly afterwards, fur trappers, lured to the region by potential fur fields, stimulated interest in the Yellowstone country, and in 1803 the United States government established its first claim to the region by the Louisiana Purchase. Subsequently, in 1804, Lewis and Clark were dispatched to explore the area.

In 1822, the Atkinson expedition was sent to the Yellowstone country to establish a peace treaty with the tribes. Doomed by forces of white expansion, the treaties failed and the stage was set for the Indian wars of the late 19th century. In 1864, John Bozeman brought a wagon train of immigrants through the region,

establishing a route through the Indian hunting grounds that became known as the Bozeman Trail. Shortly afterwards, in 1860, Nelson Story made the first cattle drive to Montana. Resenting these and many other incursions into their hunting grounds, the Northern Cheyenne, followed shortly by the Sioux, fought to retain their lands.

The Indian wars of the northern plains reached a peak of intensity in 1876 when General Crook marched up Rosebud Creek and encountered the Northern Cheyenne on June 17th in the battle the Cheyenne refer to as "Where the Girl Saved Her Brother" (Stands in Timber and Liberty 1967:181) or what, in white records, is called the "Battle of the Rosebud". A scant week later on June 25th, 1876, General Custer found the Sioux and Cheyenne camped on the Little Big Horn River and made his fateful charge. Although "Custer's Massacre" was perhaps the finest hour of the Sioux and Cheyenne, their efforts to retain their land and freedom was a losing cause, and by 1884 the Northern Cheyenne reservation had been established. Soon, white settlers were entering the region and the era of large cattle, horse, and sheep ranching arrived.

Archaeological Survey

Techniques

An archaeological survey can be defined simply as an inventory and field reconnaissance of a region's archaeological values. Initial phases of the present survey, involved seeking the res-

pective landowners' permissions to survey the areas under investigation, discussing with them and questioning them about locally known archaeological sites, and frequently visiting the sites with them. These sites, though not necessarily in the survey lands proper, provide background information relevant to an understanding of the region's archaeology.

Actual field survey was conducted by systematically walking over all land surface designated by contract, and looking for signs of aboriginal usage. By covering the terrain in an organized pattern, all hills, flats, and ridges were investigated and searched for archaeological remains. All dry washes were walked, and their exposed cutbanks examined for subsurface archaeological sites that might have been exposed by erosion. All sites found were then numbered according to the Smithsonian system and recorded on Statewide Archaeological Survey forms. Photographs were taken, and if the site warranted further attention, it was tested and mapped.

The Sites

Foss Site, 24RB1001. Several sites were shown to the survey crew by local residents of Decker. One of the sites, the Foss site, 24RB1001, had just been excavated by the Sheridan Archaeological Society under the direction of Dr. George Frison of the University of Wyoming. The Foss site is a bison kill, located on the Foss Ranch just south of Decker, Montana, at which bison had been killed or crippled when driven over a relatively low cliff affording a

drop of approximately 10 feet. Frison describes the site as belonging to the Late Prehistoric Period and has obtained a radio-carbon date of 1250 B.P. for the site (Frison, personal communication 1971).

Decker Hearth Site, 24RB1002. Site 24BH1002 is located about 100 yards east of a state secondary road leading to Decker, in the northeast quarter of the southeast quarter of the southwest quarter of Sec. 9, T9S, R40E. The site consisted of the scattered remains of single hearth that had been exposed by pan erosion on the south side of a major east-west oriented dry wash. The hearth had originally been covered by about 2 feet of soil. It retained none of its original form and contained no charcoal. No evidence of additional hearths was found. Debitage (or scrap flakes left as waste from the making of lithic tools) of red jasper, quartzite, and red and gray porcelanites had been secondarily deposited on the hard pan surface as sheet erosion removed the top soil. A single artifact, and eared projectile point, was recovered from the same hard pan surface and general area of the hearth. It could not be determined whether the point was in association with the hearth.

Lookout Sites, Including Buzzard Point Site (24RB1004). One of the most common site types found during the summer consisted of small (5 to 20 square feet) deposits of scrap flake material and sometimes a few artifacts. Located on high points and projections of ridges, these lookout sites characteristically afford a com-

standing view of the grassy basins below in at least one direction. Site numbers were not assigned to these flake concentrations unless evidence of repeated use was apparent.

During the course of the Decker survey several of these small lookout areas were located. One typical of these lookout sites was situated on the eroded outcrops located in the northeast quarter of the southeast quarter of Sec. 9, T9S, R40E. A number of flakes of red and grey porcelanite were in evidence, but no artifacts were present. From the site, one has an excellent view of the survey basin to the west and also the Tongue River valley to the east.

The Buzzard Point site, 24RB1004, is a lookout site that had been used a number of times. Though not on actual survey acreage, the site has bearing on this study as it provides an excellent view of the basin containing the survey lands as well as the country to the north. This lookout station is located on the high ridge forming the north wall of the survey basin. The site contained lithic debris of red and grey porcelanite scattered over an area approximately 10 yards square. It yielded several unidentifiable artifact fragments.

Cox Fortification, 24RB1003. Site 24RB1003, located 1/2 mile west of the Decker Coal Company lands, was shown to the survey crew by Don Cox of the Bar 21 Ranch. This site, located on the northwest quarter of the southeast quarter of Sec. 7, T9S, R40E, is an apparent fortification site composed of several disturbed, small

tipi rings situated 30 feet north and in front of a rock barricade. Built from amorphous sandstone boulders piled one on top of another in a haphazard pattern, the fortification extends approximately 30 feet from ridge edge to ridge edge and averages 2 feet in height. A considerable amount of debitage and several hearths are eroding from the surface. Mr. Cox reported finding a small side-notched point and a metal point at this site during previous visit. An inspection of a high bluff on the same ridge 100 yards north of the fortification resulted in the finding of a typical lookout site at which a number of flakes were found.

Miscellaneous Find--Eden Valley Projectile Point

The most important discovery made on Decker survey lands was a single projectile point, an excellent example of a transverse oblique-flaked Eden Valley point (Fig. 2). The point was found on the floor of a dry wash approximately 10 feet deep. There was no evidence of a possibly related site in or near the wash where the Eden Valley point was recovered. How far the point may have been moved by erosion from its original position is unknown. In all probability, the Eden point simply had been lost by its owner, perhaps having been dropped, or lost as the result of an intended quarry being missed or only wounded.

Generally recognized as representing the finest flint knapping in North America, Eden points are divided by Wormington (1964:125) into two types: those exhibiting collateral flaking and those with transverse oblique flaking. The Decker Eden

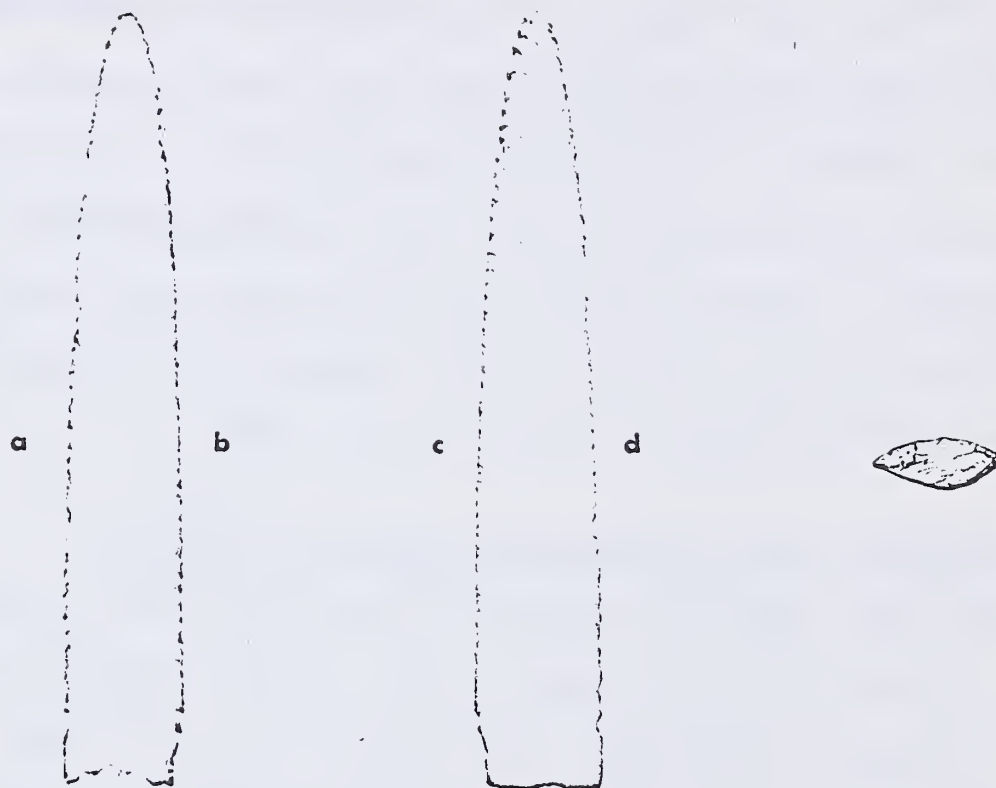


Fig. 2. The Decker Eden Valley projectile point. View of both sides and cross-section.

Valley point exhibits the transverse oblique type of flaking pattern. In cross-section, Eden points generally have a distinctive diamond shape, being relatively thick for their width. The Decker specimen, made of red porcelanite, exhibits this typical diamond cross-section. Basal grinding exists on only one edge of the specimen (that edge between sides a and d, see Fig.2) producing an almost imperceptible shoulder. The base has been thinned. Flaking scars run obliquely from the blade edges to the median ridge of the blade for the entire length of the point. An interesting characteristic is that on sides b and c, (see Fig. 2) each individual flake channel runs clearly and unbroken from the edge of the blade to the median ridge, and the placement of the flake channels along the length of the blade is uniform. The individual flake channels on sides a and d, however, frequently terminate halfway between the blade edge and the median ridge, at which point second flake channels continue the remaining distance. The placement of these flake scars along the length of the blade is not as uniform on sides a and d as it is on sides b and c. Thus, the superior quality of workmanship for sides a and c as opposed to sides b and d is apparent. Whether this difference in quality is due to the right or left handedness of the craftsman or some other factor is unknown.

Table 1 compares the measurements of the Decker specimen with the normal range of Eden points as established by Wheat (1972:149). The Decker Eden Valley point is slightly smaller

TABLE 1

Dimensions and Indices of Eden Valley Projectile Points

	<u>Normal Range*</u>	<u>Decker Specimen</u>
Absolute length (mm.)	100.0-120.0	98.4
Absolute width (mm.)	17.5-19.0	16.5
Total length/ blade width (%)	17.0-19.0	16.8
Blade length/ blade width (%)	19.0-22.0	18.6
Blade width/ stem (base) width (%)	87.5-92.5	92.4
Blade width/ blade thickness (%)	40.0-45.0	43.3
Blade length/ stem length (%)	14.5-16.0	10.6

*After Wheat 1972:149.

than the normal range in all respects, except for blade width and thickness.

The finding of the Eden Valley point indicates that people utilized the Decker area as long ago as 8000 B.C. These peoples were nomadic hunters who lived in small groups and utilized a wide variety of food resources for subsistence, the most important of which was bison. Eden Valley points are frequently found in association with Scottsbluff-type projectile points, and because of this frequent association, the Eden Valley point is often included as part of the Cody tool complex.

The distribution of Eden Valley points is generally believed to be more restricted than that of its contemporary, the Scottsbluff type. Wormington (1964:124) indicates the distribution of Eden Valley to be primarily on "the high plains and areas to the north". Wheat (1972:153) notes their distribution to be "primarily on the high plains and especially in northern Colorado, Wyoming and western Nebraska". Excavations at the Finley (Satterthwaite 1957) and Horner (Jepson 1953) sites in Wyoming, and the Claypool (Dick and Mountain 1960) and Olsen-Chubbock (Wheat 1972) sites in Colorado have recovered Eden Valley projectile points.

Conclusions

Several tentative conclusions based on the results of the survey of Decker Coal Company lands can be made. Prehistoric occupation of the lands now leased by the Decker Coal Company began

at least 9000 years ago as evidenced by the Eden Valley point. Intermittent occupation of the region from that time into historic time is indicated by the presence of more recent forms of projectile points found at sites located on the periphery of the survey area. The Foss Kill site indicates that the region sustained a population that, around A.D. 700, organized communal bison hunts. It is reasonable to assume that subsequent to the Foss site time (1250 B.P.) a stable population utilized the area consistently. The Cox Fortification yielded a metal projectile point, which would indicate use of the area into early historic times.

The most common site type found during the survey was lookouts. These lookout sites or "observation posts" are located along the crests of the high ridges adjacent to the survey area. Their abundance suggests that utilization of ridges as lookouts or as travel routes was important in the lifeway of prehistoric peoples. The location of game or observation of game movements would have been crucial to the economy, but also important would have been the detection of the presence of outsiders, friendly or otherwise.

By utilizing lookout stations, planning communal bison hunts, and otherwise exploiting the animal and vegetable resources of the area, man lived successfully in this area of south-central Montana for at least 8000 years B.C.

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THE SHERIDAN COAL FIELD, WYOMING.

By JOSEPH A. TAFF.

INTRODUCTION.

This report is a brief discussion of the economic geology of the coal in the Sheridan field, Wyoming, and includes in addition only so much of the stratigraphy, topography, structure, and culture as seem to have a bearing on the development of the coal field. A more complete report on the coal fields of northeastern Wyoming, east of the Bighorn Mountains, is contemplated, to be prepared when geologic surveys are carried farther south and east.

The Sheridan field is covered by public-land surveys, and no maps other than township plats were available for field use, with the exception that a small part of the coal area west of the longitude of Sheridan is within the Dayton quadrangle and has been surveyed topographically. The principal object in the survey being the classification of the coal land, it was necessary that all points should be located with reference to the Land Office unit of subdivision—the section. Many of the section corners could not be found, even in the larger valleys where settlements have been made. In the rougher parts of the field the number of corners that could be found was still less, and many of those that were located contained no distinctive markings. Local county and other surveyors report that great difficulty has been encountered in locating settlers ~~with their lands, the only~~ corners that could be found being in many cases several miles distant from these lands. Moreover, the locations of stream crossings on section lines and of other topographic features shown on the township plats were found to be so erroneous as to suggest that a considerable part of the land subdivisions had never been made.

The map (Pl. VIII) accompanying this paper is based on compass surveys tied to known land corners and to each other. Distances were measured by pacing on section lines or from section corners. In the eastern and central parts of the field but few section corners could be found. The traverse lines between known section corners were long, and even when these lines are adjusted to each other and to the known corners the locations of many points are only approximately correct.

17.4 SOILS CONSERVATION SURVEY REPORT, DECKER COAL COMPANY

DECKER COAL CO.

MAPPING SYMBOL	NAME	WINDBREAK GROUP
2E	HGb Haverson and Lohmiller soils, channeled	4
10A	HGa Haverson and Glenberg spils	2W
12A	Hfa Haverson loam, 0-2% slopes	1
13C	Lr Lohmiller silty clay loam, 4-8% slopes	1
13D	Ls Lohmiller silty clay loam, 8-15% slopes	1
19A	Ks Kyle silty clay, 0-2% slopes	1
19B	Kt Kyle silty clay, 2-4% slopes	1
21B	Mr McRae loam, 1-4% slopes	1
21C	Ms McRae loam, 4-8% slopes	1
24B	Fk Fort Collins loam, 2-4% slopes	1
24C	Fm Fort Collins loam, 4-8% slopes	1
25A	Hla Heldt silty clay loam, 0-2% slopes	1
25B	Hlb Heldt silty clay loam, 2-4% slopes	1
25C	Hlc Heldt silty clay loam, 4-8% slopes	1
35C	Re Renohill silty clay loam, 2-8% slopes	2M
36C	THb Theduland-Cushman loams, 4-8% slopes	2M
37C	Cz Cushman loam, 4-8% slopes	3M
38C	Td Terry fine sandy loam, 4-8% slopes	2M
47B	Cf Chugter loam, 2-8% slopes	1
58B	Hng Hydro-Allentine complex, 1-4% slopes	3S
77B	Hna Hydro-Allentine complex, 4-8% slopes	2S
123D	To Thurlow-Midway silty clay loams	1
129E	TCb Terrace escarpments, loamy	4
134F	Soc Midway-shale outcrop complex, 25-90% slopes	4
136D	THc Theduland-Midway complex, 8-25% slopes	3M
177B	Hna Hydro loam, 0-8% slopes	2S
177C	Hna Hydro loam, 0-8% slopes	2S
229E	CK Clapper-Midway complex - 15-35% slopes	4
238C	Nd Nelson fine sandy loam, 2-15% slopes	3M
277B	Hnf Hydro silty clay loam, 2-4% slopes	2S
313D	LV Lohmiller-Midway silty clay loams, 4-15% slopes	2M
334E	MVf Midway-Theduland complex, 15-35% slopes	4
336D	THd Theduland-McRae loams, dissected	2M
347C	St Spearman loam, 4-8% slopes	2M
362D	Wr Wibaux-Spearman complex, 8-15% slopes	3M
421B	Mr McRae loam, 1-4% slopes	1
421C	Ms McRae loam, 4-8% slopes	1
436C	TS Travessilla-Theduland loams, 2-15% slopes	3M
438C	Nd Nelson fine sandy loam, 2-15% slopes	3M
638D	NF Nelson-Glenberg fine sandy loams, 8-20% slopes	3M
736D	THm Theduland-Wibaux complex, 8-15% slopes	3M
736E	THn Theduland-Wibaux stony loams, 15-35% slopes	4

ESTIMATED PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

MAP SYMBOLS	SOIL SERIES	DEPTH TO:		Depth From Surface (INCHES)	CLASSIFICATION			Percentage larger than 3"	PERCENTAGE PASSING SIEVE				PERMEABILITY (INCHES PER HR.)
		Bedrock Gravel, etc. (INCHES)	Seasonal Water Table (FEET)		USDA TEXTURE	UNIFIED	AASHO		NO. 4	NO. 10	NO. 40	NO. 200	
47B 229E 360, 370	CHUGTER CLAPPER CUSHMAN	40-60" to gravel	—	0-63 0-58 0-10 10-35 35	LOAM GRAVELLY LOAM CLAY LOAM LOAM SHALE	ML SM CL CL	A-4 A-4 A-4 A-6	— 10 — —	100 70-90 100 100	100 65-80 100 100	80-90 55-70 90-100 90-100	60-75 40-55 70-80 60-75	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0
24B, 24C 10A, 638D 2E, 10A, 12A 25A, 25B, 25C, 58B, 77B 177B, 177C, 277B	FORT COLLINS GLENBERG HAVERSON HELDT HYDRO	— — — — — —	— — — — — —	0-12 12-63 0-58 0-33 33-60 0-60 0-39 39-65	CLAY LOAM LOAM SANDY LOAM LOAM SANDY LOAM SILTY CLAY LOAM SILTY LOAM SILTY CLAY LOAM	CL ML SM ML SC	A-4 A-4 A-2 A-4 A-4	— — — — —	100 100 100 100 100	100 100 100 100 100	70-90 55-95 60-70 85-95 60-70	70-80 60-75 30-40 60-75 30-40	2.6-2.0 0.6-2.0 2.0-6.0 0.6-2.0 2.0-6.0
19A, 19B 2E, 13C, 13D 21B, 21C 638D, 421B 421C	KYLE LOHMILLER McRAE MIDWAY	— — — 10-20" to shale	— — — —	0-62 0-63 0-63 0-11	CLAY SILTY CLAY LOAM LOAM SILTY CLAY LOAM	CL CL ML CL	A-7 A-6 A-4 A-6	— — — —	100 100 100 95-100	100 100 100 90-95	95-100 85-95 85-95 75-85	85-95 60-75 70-80	0.06-0.2 0.06-0.2 0.06-0.2 0.06-0.2
238C, 438C, 638D	NELSON	20-40" to sandstone	—	0-29 29	SANDY LOAM SANDSTONE	SM	A-2	—	100	100	60-70	30-35	2.0-6.0
35C	RENOHILL	20-40" to shale	—	0-33 33	SILTY CLAY LOAM SHALE	CL	A-6	—	100	100	95-100	85-95	0.06-0.2
134F 347C, 362D	SHALE OUTCROP SPEARMAN	20-40" to shale	—	0-15 15-23 23	TOO VARIABLE LOAM CHANNERY LOAM SHALE	TO RATE CL CL	TO RATE A-4 A-4	TO RATE — 10	TO RATE 100 65-75	TO RATE 95-100 60-70	TO RATE 85-95 55-65	TO RATE 60-70 45-55	TO RATE 2.0-6.0 2.0-6.0
129E	TERRACE ESCARPMENTS	—	—	—	TOO VARIABLE	TO RATE	TO RATE	TO RATE	TO RATE	TO RATE	TO RATE	TO RATE	TO RATE
38C	TERRY	20-40" to sandstone	—	0-25 25	SANDY LOAM SANDSTONE	SM	A-2	—	95-100	85-95	60-70	30-40	2.0-6.0
36C, 136D 334E, 336D 436C, 736D 736E	THEDULAND	20-40" to shale	—	0-28 28	LOAM SHALE	ML	A-4	—	100	100	85-95	65-75	0.6-2.0
123D 436C	THURLOW TRAVESSILLA	10-20" to hard sandstone	—	0-61 0-18 18	SILTY CLAY LOAM SANDY LOAM SANDSTONE	CL SM	A-6 A-2 or A-4	— —	100 100	100 100	95-100 60-65	90-95 30-40	0.6-2.0 6.0-20.0
362D, 736D, 736E	WIBAUX	10-20" to hard shale	—	0-9 9	CHANNERY LOAM SHALE	CL	A-2	35	55-65	50-60	40-50	20-30	2.0-6.0
—	—	Greater Than 5'	—	—	—	—	—	None	—	—	—	—	—

ENGINEERING INTERPRETATIONS

SOIL SERIES	SUITABILITY AS SOURCE OF:			SOIL FEATURES AFFECTING		
	ROADFILL	SAND AND GRAVEL	TOPSOIL	RESERVOIR POND AREAS	DAMS, DIKES AND LEVEES	DRAINAGE FOR CROPS & PASTURE
CHUGTER	Poor: frost action potential is high	Not a source	Good	moderately rapid permeability	moderate compacted permeability; medium piping hazard	unstable ditch banks
CLAPPER	Poor: frost action potential is high	Fair: fines are loam in upper 3 feet	Fair: more than 5% coarse fragments	Some slopes greater than 8%	high piping hazard; high volume of gravels and cobbles	Not applicable
CUSHMAN	Poor: frost action potential is high	Not a source	Fair: clay loam texture	depth to bedrock is less than 40 inches	medium shear strength	Not applicable
FORT COLLINS	Poor: frost action potential is high	Not a source	Fair: clay loam texture	All features favorable	medium piping hazard	All features favorable
GLENBERG	Poor: frost action potential is high	Fair to poor: 4-5 feet of overburden; water table 4-6 feet	Good	rapid permeability	high piping hazard; moderate compacted permeability	unstable ditch banks
HAVERSON	Poor: frost action potential is high	Fair: on river terraces only; 3-6 feet of overburden	Good	water table at 5 feet on the river floodplains	low shear strength; high piping hazard	unstable ditch banks
HELDT	Poor: frost action potential is high	Not a source	Fair: silty clay loam texture	some moderate slopes	fair compaction; moderate shrink-swell potential	All features favorable
HYDRO	Poor: frost action potential is high	Poor: 4-5 feet of overburden on the gravel terraces only	Poor: less than 8 inches thick	some moderate slopes	medium shear strength	Not applicable
KYLE	Poor: shrink-swell potential is high	Not a source	Poor: silty clay texture	some moderate slopes	high shrink-swell potential; high compressibility	very slow permeability

2 OF 3

ENGINEERING INTERPRETATIONS

Soil Series	SUITABILITY AS SOURCE OF:			SOIL FEATURES AFFECTING:		
	ROADFILL	SAND AND GRAVEL	TOPSOIL	RESERVOIR POND AREAS	DAMS, DICES AND LEVEES	DRAINAGE FOR CROPS & PASTURE
LOHMEYER	Poor: frost action potential is high	Fair: 4-5 feet of overburden on the river floodplains only	Fair: silty clay loam texture	All features favorable	Fair compaction; medium shear strength	moderately slow permeability
MERRAE	Poor: frost action potential is high	Not a source	Good	All features favorable	medium piping hazard	Not applicable
MIDWAY	Poor: depth to shale is less than 20 inches	Not a source	Poor: less than 8 inches thick	Shale at less than 20 inches	Fair compaction; medium compressibility	Not applicable
NELSON	Poor: frost action potential is high	Not a source	Fair: less than 16 inches thick	Moderately rapid permeability	Medium shear strength and piping hazard	Not applicable
RENOHILL	Poor: frost action potential is high	Not a source	Fair: silty clay loam texture	shale less than 40 inches	Fair compaction	Not applicable
SHALE OUTCROP	TOO VARIABLE TO RATE					
SPEARMAN	Poor: frost action potential is high	Not a source	Fair: less than 16 inches thick	moderately rapid permeability	Fair compaction; medium piping hazard	Not applicable
TERRACE ESCARPMENTS	TOO VARIABLE TO RATE					
TERRY	Poor: frost action potential is high	Not a source	Fair: less than 16 inches thick	high seepage potential	medium susceptibility to piping	Not applicable
THE DULAND	Poor: frost action potential is high; some slopes greater than 25%	Not a source	Fair: less than 16 inches thick	sandstone and shale at less than 40 inches	medium susceptibility to piping	Not applicable
THURLOW	Poor: frost action potential is high	Not a source	Fair: silty clay loam texture	All features favorable	Moderate: shrink-swell potential	All features favorable

[illegible]

ENGINEERING INTERPRETATIONS

DEGREE AND KIND OF LIMITATION FOR:

SOIL SERIES	SEPTIC TANK ABSORPTION FIELDS	SEWAGE LAGOONS	SHALLOW EXCAVATION	DWELLINGS WITH BASEMENTS	SANITARY LANDFILL TRENCH TYPE	ROADS AND PARKING AREAS
CHUGTER	Moderate: some slopes of 8-15 % Slight: permeability	Severe: moderately rapid permeability	Moderate: 8-15 % slopes Slight: 2-7 % slopes	Severe: frost action potential is high	Severe: moderately rapid permeability	Severe: frost action potential is high
CLAPPER	Severe: slopes greater than 15 % Moderate: 8-15 % slopes Slight: permeability	Severe: slopes greater than 7 %	Moderate: 8-15 % slopes	Severe: frost action potential is high	Moderate: 15-25 % slopes Slight: 0-15 % slopes	Severe: frost action potential is high
CUSHMAN	Slight or moderate: permeability	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches	Severe: frost action potential is high; less than 40" to bedrock	Severe: depth to bedrock is less than 60 inches	Severe: frost action potential is high
FORT COLLINS	Slight or moderate: permeability	Moderate: moderate permeability; 2-7 % slopes	Slight: 0-8 % slopes	Severe: frost action potential is high	Moderate: clay loam texture	Severe: frost action potential is high
GLENBERG	Moderate: flooding hazard and water table on the river terraces	Severe: rapid permeability	Slight: 0-8 % slopes	Severe: frost action potential is high	Severe: rapid permeability; water table on the river terraces	Severe: frost action potential is high
HAVERSON	Slight or moderate: permeability; flooding hazard on the river and water table terraces	Moderate: moderate permeability; flooding hazard on the river terraces	Slight: 0-8 % slopes	Severe: frost action potential is high	Slight: loam texture	Severe: frost action potential is high
HELDT	Moderate: moderate permeability; some 8-15 % slopes	Moderate: moderate permeability	Moderate: 8-15 % slopes Slight: 0-8 % slopes; silty clay loam texture	Severe: frost action potential is high	Moderate: silty clay loam texture	Severe: frost action potential is high

ENGINEERING INTERPRETATIONS DEGREE AND KIND OF LIMITATION FOR:

SOIL SERIES	SEPTIC TANK ABSORPTION FIELDS	SEWAGE LAGOONS	SHALLOW EXCAVATION	DWELLINGS WITH BASEMENTS	SANITARY LANDFILL TRENCH TYPE	ROADS AND PARKING AREAS
HYDRO	Severe: slow permeability	Moderate: 2-7% slopes Slight: 0-1% slopes	Slight: silty clay loam texture	Severe: frost action potential is high	Moderate: silty clay loam texture	Severe: frost action potential is high
KYLE	Severe: Very slow permeability	Severe: slopes greater than 7% Moderate: 2-7% slopes Slight: 0-1% slopes	Severe: silty clay texture	Severe: shrink-swell potential is high	Severe: silty clay texture	Severe: shrink-swell potential is high
LOHMILLER	Moderate: moderately slow permeability	Severe: slopes greater than 7% Moderate: 2-7% slopes Slight: 0-1% slopes	Moderate: silty clay loam texture	Severe: frost action potential is high	Moderate: silty clay loam texture	Severe: frost action potential is high
MORAE	Slight to moderate: moderate permeability; 0-8% slopes	Severe: slopes greater than 7% Moderate: moderate permeability; 2-7% slopes	Moderate: slopes greater than 8% Slight: 0-8% slopes	Severe: frost action potential is high	Slight: loam texture	Severe: frost action potential is high
MIDWAY	Severe: depth to bedrock is less than 20 inches; some slopes more than 15%	Severe: depth to bedrock is less than 20 inches; some slopes greater than 7%	Severe: depth to bedrock is less than 20 inches; slopes greater than 15%	Severe: depth to bedrock is less than 20 inches; slopes greater than 15%	Severe: depth to bedrock is less than 20 inches; some slopes greater than 25%	Severe: depth to bedrock is less than 20 inches; some slopes greater than 8%
NELSON	Severe: depth to bedrock is less than 48 inches	Severe: some slopes greater than 7%; moderately rapid permeability	Moderate: slopes greater than 8% Slight: 2-8% slopes	Moderate: 8-15% slopes	Severe: moderately rapid permeability	Severe: some slopes greater than 8%; frost action potential is high

ENGINEERING INTERPRETATIONS DEGREE AND KIND OF LIMITATION FOR:

SOIL SERIES	SEPTIC TANK ABSORPTION FIELDS	SEWAGE LAGOONS	SHALLOW EXCAVATION	DWELLINGS WITH BASEMENTS	SANITARY LANDFILL TRENCH TYPE	ROADS AND PARKING AREAS
RENOHILL	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches; frost action potential is high	Severe: depth to bedrock is less than 40 inches	Severe: some slopes greater than 8%; frost action potential is high
SHALE OUTCROP	TOO VARIABLE TO RATE					
SPEARMAN	Severe: depth to bedrock is less than 40 inches; some slopes greater than 15%	Severe: depth to bedrock is less than 40 inches; some slopes greater than 7%	Severe: depth to bedrock is less than 40 inches; some slopes greater than 15%	Severe: depth to bedrock is less than 40 inches; some slopes greater than 8%	Severe: depth to bedrock is less than 40 inches	Severe: frost action potential is high; some slopes greater than 8%
TERRACE ESCARPMENTS	TOO VARIABLE TO RATE					
TERRY	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches	Severe: frost action potential is high
THEDULAND	Severe: depth to bedrock is less than 40 inches	Severe: depth to bedrock is less than 40 inches; some slopes greater than 7%	Severe: depth to bedrock is less than 40 inches; some slopes greater than 15%	Severe: depth to bedrock is less than 40 inches; some slopes greater than 8%	Severe: depth to bedrock is less than 40 inches; some slopes greater than 25%	Severe: frost action potential is high; some slopes greater than 8%
THURLOW	Slight or moderate: moderate permeability	Moderate: moderate permeability; 0-7% slopes	Moderate: clay loam texture	Severe: frost action potential is high	Slight: clay loam texture	Severe: frost action potential is high
TRAVESSILLA	Severe: depth to bedrock is less than 20 inches	Severe: depth to bedrock is less than 20 inches; some slopes greater than 7%	Severe: depth to bedrock is less than 20 inches	Severe: depth to bedrock is less than 20 inches; some slopes greater than 8%	Severe: depth to bedrock is less than 20 inches	Severe: depth to bedrock is less than 20 inches; some slopes greater than 8%
WIBAUX	Severe: depth to bedrock is less than 20 inches; some slopes greater than 15%	Severe: depth to bedrock is less than 20 inches; slopes greater than 7%	Severe: depth to bedrock is less than 20 inches; some slopes greater than 15%	Severe: depth to bedrock is less than 20 inches; slopes greater than 8%	Severe: depth to bedrock is less than 20 inches; some slopes greater than 25%	Severe: depth to bedrock is less than 20 inches; slopes greater than 8%

SHRUB AND TREE ADAPTATIONS RATING BY SOIL GROUPS

SPECIES	SOIL SUITABILITY													
	1		2M		2S		2W		3M		3S		4	
	IRR.	DRY	IRR.	DRY	IRR.	DRY	IRR.	DRY	IRR.	DRY	IRR.	DRY	IRR.	DRY
<u>SHRUBS</u>														
Caragana	X	X	X	X	X	X			X	X	X	X		
Honeysuckle	X	X	X	X	X		X	X	X					
Lilac	X	X	X	X	X		X	X	X		X			
Chokecherry	X	X	X	X	X	X	X	X	X					
American Plum	X	X	X	X	X	X	X	X	X					
Skunkbush Sumac	X	X	X		X	X	X	X	X		X	X		
Purple Willow	X		X				X	X	X					
Buffaloberry	X	X	X	X	X	X	X	X	X	X	X	X		
Sandcherry	X	X	X	X	X		X	X	X	X				
Nanking cherry	X	X	X	X				X	X					
Cotoneaster	X	X	X				X	X	X					
Arborvitae	X	X	X				X	X	X					
Dogwood	X	X	X				X	X	X					
<u>LOW TREES</u>														
Russian olive	X	X	X	X	X	X	X	X	X	X	X	X		
Siberian Crabapple	X	X	X	X			X	X	X	X				
Arnold hawthorn	X	X	X		X		X	X	X					
Amur Maple	X	X	X	X			X	X	X					
Hackberry	X	X	X				X	X	X					
<u>TALL TREES</u>														
Green Ash	X	X	X	X			X	X	X					
Siberian Elm	X	X	X	X	X	X	X	X	X	X	X	X		
White Willow	X	X	X				X	X	X					
Golden Willow	X	X	X				X	X	X					
Cottonwood	X	X	X		X		X	X	X		X			
Silver Maple	X	X	X	X			X	X	X					
Black Locust	X	X	X	X	X		X	X	X		X			
Honey Locust	X	X	X	X	X		X	X	X		X			
<u>EVERGREENS</u>														
Ponderosa Pine	X	X	X	X	X	X	X	X		X				
Scotch Pine	X	X	X	X	X		X	X						
Colorado Blue Spruce	X	X	X	X			X	X	X					
Rocky Mt. Juniper	X	X	X	X	X	X	X	X	X	X				
Douglas fir	X	X	X	X					X					



Clapper-Midway complex, hilly (15 to 35 percent slopes (CK)). --

This complex comprises hilly soils in areas where shale lands are capped by gravel terraces. Most commonly it is a single, steep escarpment that separates the undissected part of the terraces from the eroded lower lying gravelly shale ridges and hills. Numerous short drains carrying runoff from the terrace surface have cut the face of the escarpment into a pattern of narrow, sharply sloping ridges separating the drains and coulees. The shale bedrock is exposed in these drains and on the lower side of the escarpment where slopes range from 30 to 40 percent. It consists of 50 to 60 percent Clapper gravelly loam, 30 to 40 percent Midway clay loam, and 5 to 10 percent shale outcrop. The Clapper soils are on the terrace edge, and upper side of the escarpment. The wider ridges between the drainageways also have the Clapper soils. The Midway soils are on the lower sides of the ridges and hills where the gravel no longer covers the shale bedrock. The soils have profiles similar to those described for the respective series.

The runoff is rapid, the erosion hazard is severe.

These soils are used for range.

(Capability Unit VIe Dryland; Thin Hilly range site 10-14 inch precipitation zone; Windbreak Suitability Group 4).

Hydro-Allentine complex, 1 to 4 percent slopes (Hng). --

This complex comprises nearly level and gently sloping soils on fans and terraces. Hydro loam makes up 60 to 80 percent of the complex and Allentine silty clay makes up 20 to 40 percent. The thin grass cover or hard clods in plowed fields mark the areas of Allentine silty clay. Where the soils have not been plowed, the Allentine soil lies in 3 to 6 inch deep micro depressions.

The Hydro and Allentine soils in this complex have characteristics similar to those described for their respective series. Some map areas have a few spots of Bone clay included with these soils.

Surface runoff is slow, and the erosion hazard is slight.

This complex is suited for range. It is also suited to dryland crops when the amount of Allentine soil is not over 20 percent. (Capability Unit IVs-2 Dryland; Pan Spots range site 10-14 inch precipitation zone; Windbreak Suitability Group 3S).

Terry Series

The Terry series consists of moderately deep, undulating, well-drained soils on ridges and hills of sandstone plains. Slopes are mainly 4 to 8 percent but range downward to 2 percent. They formed in material weathered in place from calcareous sandstones at elevations of 3000 to 3800 feet.

Vegetation is mainly needle-and-thread, big sage, western wheatgrass, Hoods phlox, and plains prickly pear. Annual precipitation is 13 to 14 inches, the mean annual soil temperature is 47 to 49 degrees F., the frost free season is 110 to 125 days.

Typically, the surface layer is brown sandy loam about 2 inches thick. The subsoil is brown sandy loam and sandy clay loam about 10 inches thick. The substratum is light brown sandy loam resting on sandstone at about 25 inches.

Permeability is moderately rapid, the effective rooting depth is about 25 inches. Available water holding capacity is ~~moderate~~ 3 to 4 inches.

These soils are used for range and dry cropland.

A typical profile of Terry sandy loam, grassland, .5 mile south of gate in fence at trail junction below the Gyp Creek airstrip in Garvin Basin, Big Horn Mountains, 35 feet west of trail.

- A -- 0 to 2 inches, brown (7.5YR 5/2) sandy loam, dark brown (7.5YR 4/3) moist; single grain structure; soft, friable, nonsticky and slightly plastic; clear smooth boundary. (2 to 4 inches thick)
- B1 -- 2 to 5 inches, brown (7.5YR 5/4) heavy sandy loam, dark brown (7.5YR 4/4) moist; weak, coarse blocky structure; slightly hard, friable, nonsticky and slightly plastic; gradual smooth boundary. (0 to 4 inches thick)
- B2t -- 5 to 12 inches, brown (7.5YR 5/4) light sandy clay loam, dark brown (7.5YR 4/4) moist; weak, coarse prismatic structure; hard, friable, slightly sticky and plastic; clear smooth boundary. (5 to 9 inches thick)
- C1ca -- 12 to 19 inches, light brown (7.5YR 6/4) heavy sandy loam, dark brown (7.5YR 4/4) moist; weak, coarse blocky structure; hard, friable, nonsticky and slightly plastic; strongly effervescent; 5 percent of volume is flat sandstone fragments; gradual wavy boundary.
- C2 -- 19 to 25 inches, light brown (7.5YR 6/3) sandy loam, brown (7.5YR 5/4) moist; massive; hard, friable, nonsticky and slightly plastic; strongly effervescent; 25 percent of volume is flat sandstone fragments; abrupt wavy boundary.
- R -- 25 to 30 inches, hard, variegated sandstone.

Depth to calcareous material ranges from 10 to 15 inches. Thickness of solum ranges from 10 to 18 inches and depth to bedrock ranges from 24 to 40 inches. Content of coarse fragments ranges from 0 to 20 percent. Texture of the B2t horizon is sandy loam with clay range of 14 to 20 percent. Segregated lime in a Bca or Cca horizon occurs as few to common fine threads and medium masses. Color hue is 7.5YR or 10YR. The A horizon color is brown and grayish brown. The B2t horizon color range is brown and dark brown. C horizon color range is light brown, pale brown, and light grayish brown.

Terry soils are associated with Travessilla and Nelson soils. They have greater depth to sandstone than the Travessilla soils. They have a B2t horizon not present in the Nelson soils.

Terry fine sandy loam, undulating (2 to 8 percent slopes) (Td). --
This soil is on sandstone plains. It occupies the low ridges and
concave areas between them on broad drainage divides. Slopes are mainly
4 to 8 percent but range downward to 2 percent. Local relief is 10 to
25 feet. The soil profile is similar to the typical one described for
the series. Included with this soil in mapping were areas of Nelson
fine sandy loam and a few low sandstone ledges on the south side of
the ridges.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is suited to dryland crops and range. Wind erosion
control is an important part of managing the cultivated soil.

(Capability Unit IVe-3 Dryland; Sandy range site 10-14 inch
precipitation zone; Windbreak Suitability Group 2M)

Thedalund-McRae loams, dissected, 4 to 35 percent slopes (THd). --
This complex comprises undulating to steep soils of the sedimentary plains. Thedalund loam makes up 40 to 65 percent of the complex, McRae loam 30 to 50 percent and Kim loam 5 to 15 percent. The Thedalund loam is in 2 to 10 acre patches on the shale knolls and ridges where slopes are 8 to 25 percent. The McRae loam is on the fans and footslopes surrounding or lying between the Thedalund soils. Narrow gullies and coulees, 5 to 15 feet deep have Kim loam on the sides and edges. Slopes are 20 to 35 percent. The Thedalund and McRae soils in this complex have profiles similar to those described for their respective series.

Surface runoff is rapid, and the erosion hazard is severe. Most areas receive runoff from the highlands that border them.

This complex is suited to range.
(Capability Unit IVe-3 Dryland; Silty range site 10-14 inch precipitation zone; Windbreak Suitability Group 2M)

Thedalund-Midway complex, rolling (8 to 15 percent slopes) (The).--
This complex comprises rolling soils of the sedimentary plains.
Thedalund loam makes up 40 to 70 percent of the complex, Midway silty
clay loam 20 to 40 percent, and McRae loam 10 to 20 percent. The
Thedalund and Midway soils lie in no predictable pattern on the hills
and ridges. The McRae loam lies in the shallow heads of drainageways
and on narrow footslopes in the wide drainageways. The Thedalund and
Midway soils in this complex have profiles similar to those described
for their respective series.

The surface runoff is medium, and the erosion hazard is moderate.

This complex is suited to range.

(Capbility Unit IVe-3 Dryland; Silty range site 10-14 inch precipitation
zone; Windbreak Suitability Group 3M)

Fort Collins loam, 2 to 4 percent slopes (Fk). --

This soil is on fans and terraces in river and intermittent stream valleys. The areas are 5 to 40 acres in size. The soil profile is the one described as typical for the series. In the areas of gravel terraces the soil may include strata of loamy sand below 30 inches. Included with the soil in mapping are small spots of McRae and Thurlow soils.

The runoff is slow and the erosion hazard moderate.

This soil is used for irrigated and dry cropland and for range. (Capability Unit 111e-3, Dryland, 11e-1 Irrigated; Silty range site 10-14 inch precipitation zone; Windbreak Suitability Group 1).

Fort Collins loam, 4 to 8 percent slopes (Fm). --

This soil is on footslopes, fans and terraces. It lies in 20 to 50 acre patches in the tributary drainageways to major stream valleys. Slope length ranges between 250 and 450 feet. The soil has a profile similar to the typical one described for the series. Included with this soil in mapping on the footslopes are narrow bands of McRae soils immediately below the residual soils of the valley rim.

The runoff is medium and the erosion hazard moderate.

This soil is used for dry and irrigated cropland and range. (Capability Unit IIIe-3 Dryland, IIIe-1 Irrigated; Silty range site 10-14 inch precipitation zone; Windbreak Suitability Group 1).

17.5 WATER QUALITY ANALYSES, OVERBURDEN ANALYSES, AND PLANT TEST SPECIES

Appendix D.*

Water quality analysis at Decker, Montana, site 1.

Sample type Well
Depth 110'
Date Sampled 6-11-71

	<u>mg/l</u>		<u>mg/l</u>
Calcium	4.40	Bicarbonate	1096.00
Magnesium	1.20	Carbonate	0.00
Sodium	421.00	Hydroxide	0.00
Potassium	6.20	Chloride	5.40
Iron	0.96	Sulfate	13.60
Manganese	0.01	Nitrate	0.00
Silica	5.00	Fluoride	3.70
pH	8.13	Phosphate	0.08
Dissolved solids	1557.00		
Specific conductance	1610.00 micromhos/cm		

Water quality analysis at Decker, Montana, site 2.

Sample type Well
Depth 110'
Date Sampled 6-14-71

	<u>mg/l</u>		<u>mg/l</u>
Calcium	3.80	Bicarbonate	1092.00
Magnesium	1.20	Carbonate	0.00
Sodium	414.00	Hydroxide	0.00
Potassium	6.20	Chloride	5.40
Iron	1.27	Sulfate	12.40
Manganese	0.00	Nitrate	0.00
Silica	6.00	Fluoride	3.70
pH	8.03	Phosphate	0.05
Dissolved solids	1546.00		
Specific conductance	1620.00 micromhos/cm		

*Data provided by the Montana School of Mines, Butte, Mont.

Appendix D. Continued.

Water quality analysis at Decker, Montana, site 3.

Sample type Well
Depth 130'
Date Sampled 7-13-71

	<u>mg/l</u>		<u>mg/l</u>
Calcium	4.40	Bicarbonate	1117.00
Magnesium	0.50	Carbonate	0.00
Sodium	420.00	Hydroxide	0.00
Potassium	5.30	Chloride	5.30
Iron	0.26	Sulfate	6.40
Manganese	0.00	Nitrate	0.00
Silica	4.00	Fluoride	3.10
pH	7.90	Phosphate	0.00
Dissolved solids	1566.00		
Specific conductance	1600.00 micromhos/cm		

Water quality analysis at Decker, Montana, site 4.

Sample type Well
Depth 130'
Date Sampled 7-16-71

	<u>mg/l</u>		<u>mg/l</u>
Calcium	7.10	Bicarbonate	1139.00
Magnesium	0.50	Carbonate	0.00
Sodium	444.00	Hydroxide	0.00
Potassium	5.00	Chloride	5.20
Iron	0.10	Sulfate	7.60
Manganese	0.00	Nitrate	0.20
Silica	4.00	Fluoride	3.90
pH	8.23	Phosphate	0.00
Dissolved solids	1616.00		
Specific conductance	1640.00 micromhos/cm		

Appendix D. Continued

Water quality analysis at Decker, Montana, site 5.

Sample type Well
Depth 153'
Date Sampled 8-14-70

	<u>mg/l</u>		<u>mg/l</u>
Calcium	4.60	Bicarbonate	1188.00
Magnesium	0.50	Carbonate	7.00
Sodium	430.00	Hydroxide	0.00
Potassium	0.00	Chloride	0.30
Iron	0.11	Sulfate	4.00
Manganese	0.00	Nitrate	2.30
Silica	7.10	Fluoride	1.20
pH	8.38	Phosphate	0.00
Dissolved solids	1645.00		
Specific conductance	1690.00 micromhos/cm		

Water quality analysis at Decker, Montana, site 6.

Sample type Well
Depth 160'
Date Sampled 8-14-70

	<u>mg/l</u>		<u>mg/l</u>
Calcium	10.00	Bicarbonate	1166.00
Magnesium	0.50	Carbonate	12.00
Sodium	452.00	Hydroxide	0.00
Potassium	0.00	Chloride	22.00
Iron	0.00	Sulfate	12.00
Manganese	0.00	Nitrate	35.00
Silica	3.30	Fluoride	2.80
pH	8.40	Phosphate	0.00
Dissolved solids	1715.00		
Specific conductance	1400.00 micromhos/cm		

Appendix D. Continued.

Water quality analysis at Decker, Montana, site 7.

Sample type Well
Depth 40'
Date Sampled 8-14-70

	<u>mg/l</u>		<u>mg/l</u>
Calcium	1.00	Bicarbonate	1011.00
Magnesium	1.30	Carbonate	4.00
Sodium	390.00	Hydroxide	0.00
Potassium	3.60	Chloride	3.40
Iron	0.06	Sulfate	1.00
Manganese	0.00	Nitrate	13.00
Silica	3.30	Fluoride	1.30
pH	8.33	Phosphate	0.00
Dissolved solids	1432.00		
Specific conductance	1390.00 micromhos/cm		

Water quality analysis at Decker, Montana, site 8.

Sample type Well
Depth 180'
Date Sampled 8-14-70

	<u>mg/l</u>		<u>mg/l</u>
Calcium	1.00	Bicarbonate	1152.00
Magnesium	1.40	Carbonate	0.00
Sodium	420.00	Hydroxide	0.00
Potassium	3.70	Chloride	5.10
Iron	0.15	Sulfate	1.00
Manganese	0.00	Nitrate	24.00
Silica	8.30	Fluoride	1.00
pH	7.92	Phosphate	0.00
Dissolved solids	1616.00		
Specific conductance	1550.00 micromhos/cm		

Table 1. Decker Coal Company test pit overburden analysis.

Sample	pH	NO ₃	ppm		mmhos	%	meq/100g		
			P	K	Salts	O.M.	Ca	Mg	Na
1	8.0	2.0	20	306	.06	.90	14	9.87	.73
2	8.6	0	23	288	21.70	.15	14	9.87	15.70
3	8.5	0	13	212	8.90	.52	14	9.87	9.94
4	8.5	0	10	196	4.60	2.00	14	9.87	4.38
5	8.1	0	13	344	11.50	.90	14	9.87	9.94
6	8.1	0	23	212	11.80	.15	14	9.87	9.12
7	8.5	0	10	140	2.60	.15	14	9.87	2.31
8	8.4	0	10	176	11.50	.90	14	9.87	9.12
$\bar{x}$	8.3	.3	15	234	9.10	.71	14	9.87	7.66

On December 2, 1971, additional overburden samples were collected from the enlarged mine pit. The samples were slightly salty and phosphorus and potassium were present in low to moderate quantities. Sodium, magnesium, and calcium content ranged from moderate to high (Table 2).

To determine the necessary chemical and physical modifications required by vegetation, samples of this overburden will be tested for vegetation productivity potential in the greenhouse. A new standard overburden analysis procedure has been developed which will provide a great deal of information on overburden samples (Appendix B).

Data accumulated to this date suggest that some overburden at the mine pit is limiting in terms of its ability to support most plant species. By proper fertilization and spoils manipulation the structure

Table 2. Decker Coal Company mine pit overburden analysis.

Sample	pH	— ppm —			mmhos	%	— meq/100g —		
		NO ₃	P	K			Ca	Mg	Na
1	8.1	0	13	384	1.0	2.10	14	9.57	1.20
2	8.3	0	10	212	1.3	.90	14	9.57	1.20
3	8.5	0	20	104	.6	.15	14	4.74	.84
4	8.5	0	18	124	.8	.15	14	5.93	1.08
5	8.7	0	18	158	2.4	1.20	7.6	3.52	3.86
6	8.4	0	54	256	2.2	5.70	14	1.74	3.74
7	8.7	0	66	160	2.6	4.10	16	1.97	4.52
8	8.5	12.2	28	176	2.3	.15	16	7.58	2.09
9	8.6	.5	25	112	1.4	.15	16	7.90	1.74
$\bar{x}$	8.5	1.4	28	187	1.6	1.62	14	5.83	2.25

Table 3. Decker Coal Company test pit topsoil analysis.

Sample	pH	— ppm —			mmhos	%	— meq/100g —		
		NO ₃	P	K			Ca	Mg	Na
1	7.8	1.5	25	272	6.1	1.9	16	7.90	1.91
2	7.5	2.5	43	240	2.3	2.3	16	7.90	1.48
3	7.9	3.3	48	208	.6	2.2	16	6.32	1.22
4	8.0	3.3	48	224	1.5	2.0	16	6.32	1.13
5	7.9	2.0	34	192	3.2	2.0	16	6.32	1.74
6	8.1	2.0	43	256	.8	2.0	16	6.16	.78
7	8.2	2.0	31	240	2.2	1.7	16	7.90	1.74
8	8.3	2.0	43	256	1.7	1.7	16	7.11	1.48
9	8.3	3.8	40	208	1.0	1.9	16	6.40	1.13
10	7.5	1.0	48	160	10.9	5.7	16	7.90	6.35
11	8.2	1.0	25	192	2.5	2.1	16	7.03	2.61
12	8.0	1.5	37	272	1.6	1.8	16	7.19	1.13
$\bar{x}$	7.9	2.2	39	227	2.9	2.3	16	7.02	1.89

DECKER MINE

Fall 1972

NATIVE SPECIES PLOTS:

Species	grams per plot	pounds per acre
Green needlegrass	3	4.5
Western wheatgrass	4	6.0
Blue grama	2	3.0
Little bluestem	1	1.5
Sideoats grama	2	3.0
Indian ricegrass	1	1.5
Slender wheatgrass	3	4.5
Big bluestem	<u>1</u>	<u>1.5</u>
Total	17	25.5

INTRODUCED SPECIES PLOTS:

Species		
Fairway crested wheatgrass	2	3.0
Nordan crested wheatgrass	2	3.0
Russian wildrye	3	4.5
Pubescent wheatgrass	2	3.0
Intermediate wheatgrass	2	3.0
Smooth brome (Manchar)	2	3.0
Winter rye	2	3.0
Tall wheatgrass	<u>2</u>	<u>3.0</u>
Total	17	25.5

NATIVE AND INTRODUCED SPECIES PLOTS:

Species		
Fairway + Nordan crested wheatgrass	3	4.5
Green needlegrass	2	3.0
Smooth brome	2	3.0
Western wheatgrass	3	4.5
Russian wildrye	2	3.0
Blue grama	1	1.5
Intermediate wheatgrass	2	3.0
Slender wheatgrass	<u>2</u>	<u>3.0</u>
Total	17	25.5

DECKER MINE

Fall 1972

Special Grass Seed Mixture:

	pounds
Fairway + Nordan crested wheatgrass	3
Smooth brome	2
Russian wildrye	2
Intermediate wheatgrass	3
Green needlegrass	2
Western wheatgrass	3
Slender wheatgrass	2.5
Pubescent wheatgrass	<u>2.5</u>
	20.0

To be seeded on special plots and slopes at rate of 25.5 lbs. per acre.

Special Seed Packets for Shrub Plots:

Big sagebrush
Rubber rabbitbrush
Skunkbush sumac
Greasewood
Four-wing saltbush

Seed Packets for Forb Plots

Ranger alfalfa : smooth brome 4:1 by weight
Ladak alfalfa
Yellow sweetclover
Crown vetch (innoculated)
Gum weed

Trees

Russian olive

W.S.W., Englewood, 1991

B ₁	E ₃	A ₁	D ₁	E ₂	D ₃	D ₂	C ₂	B ₂	A ₃	E ₁	C ₃	A ₂	C ₁	B ₂
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Plots 15 x 15 ft

Mixture	Scientific Name	Common Name
A	Rhus trilobata Chrysothamnus nauseosus Atriplex canescens	Skunkbrush sumac Rubber rabbitbrush Fourwing saltbush
B	Sarcobatus vermiculatus Gutierrezia sarothrae Fraxinus pennsylvanica	Greasewood Broom snakeweed Green ash
C	Pinus ponderosa Solanum elaeagnifolium Lonicera tartarica	Ponderosa pine Creeping nightshade Common honeysuckle
D	Atriplex confertifolia Colutea arborescens Purshia tridentata	Shadscale Common bladdersenna Antelope bitterbrush
E	Artemisia nova Yucca glauca Atriplex canescens	Black sagebrush Yucca Fourwing saltbush

Figure 5. Plot design of mixture seedlings on scoria fill below the Decker Coal Company mine office.

17.6 MISCELLANEOUS



State of Montana
State Department of Health

JOHN S. ANDERSON, M.D.
EXECUTIVE OFFICER

HELENA, MONTANA 59601

September 14, 1971

1	G. NUGENT	
✓	S. LANG	
	B. JOHNSON	
2	J. CABLE	1/2
3	F. KINNEY	
4	FILE	
5		

Mr. Sherman Lang
Decker Coal Company
P. O. Box 746
Sheridan, Wyoming 82801

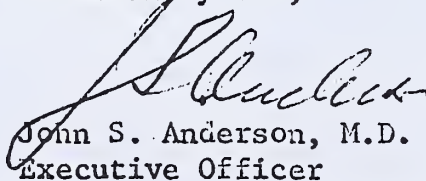
Re: Water and Sewerage
Systems for Decker Coal
Company, Decker, Montana.
Received 7/30/71.
E.S. 71/253.

Dear Mr. Lang:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Division of Environmental Sanitation, were found to be satisfactory and are herewith approved.

If the approved plans and specifications for the project are altered or if construction has not started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

Sincerely yours,


John S. Anderson, M.D.
Executive Officer

JSA:DMZ:mg

cc: Dave McCullough, Hurlbut, Kersich & McCullough, 937 Grand Avenue, Billings
Robert R. Whiting, Jr., M.D., County Health Officer, Box T, Hardin
Mr. Alf Hulteng, Regional Public Health Engineer, Box 20296, Billings



DEPARTMENT OF STATE LANDS

STATE CAPITOL

HELENA 59601

(406) 449-20

STATE BOARD OF
LAND COMMISSIONERSTHOMAS L. JUDGE
GOVERNORDOLORES COLBURG
SUPT. OF PUBLIC INSTRUCTIONFRANK MURRAY
SECRETARY OF STATEROBERT L. WOODAHL
ATTORNEY GENERAL

June 18, 1973

Mr. Frank Kinney
Land and Reclamation Engineer
Decker Coal Company
P. O. Box 746
Sheridan, WY 82801

Dear Mr. Kinney:

This letter is to acknowledge receipt of your application for a mining permit pursuant to Chapter 325 (SLM 1973) on June 11, 1973. Receipt of your application and fee fulfills the requirements of Section 27 of that act.

The Department does not consider your application and attached information, if any, as complete insofar as the Departmental review limitations of Section 10 of the act apply. As you know, final rules and regulations to implement this act have not been promulgated. A public hearing is scheduled for July 19-20, 1973, on the proposed rules. Final adoption will not likely occur until mid-August.

Until such time as final rules and regulations are promulgated, no operator could be aware of all the requirements as to application information, mining or reclamation plans. We will notify you at such time as the Department considers your application to be complete. Subsequent to rule adoption, the Department will proceed with the timely review of all applications for strip mining permits under the law.

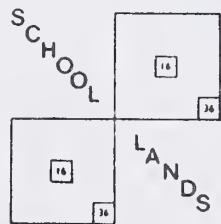
We are aware that existing operations have been given six months notice of cancellation of existing contracts as required by law. Your continued cooperation will be appreciated as the months ahead will be most difficult by any standard.

If you have any questions, please let me know.

Sincerely,

Ted Schwinden
Ted Schwinden, Commissioner
Department of State Lands
TS/c

	G. Nugent
	B. Aikman
	L. Gaspar
	B. Gourley
	B. Johnson
	F. Kinney <i>JK</i>
	S. Lang
✓	J. Patchye
	J. Pulli
✓	D. Stalla
	R. Spahn
<i>TPW</i>	
	FILE



A

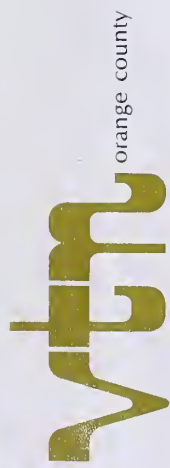
RESOURCE

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PRESENT

AN

OPPORTUNITY

FOR THE
FUTURE



ENGINEERS ARCHITECTS PLANNERS 2301 CAMPUS DRIVE, IRVINE, CALIFORNIA 92664

